

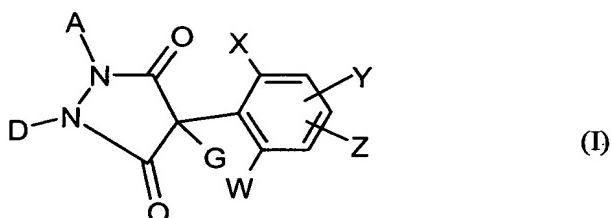
4-Biphenyl-substituted 4-substituted pyrazolidine-3,5-diones

The present invention relates to novel 4-biphenyl-substituted 4-substituted pyrazolidine-3,5-diones, to a plurality of processes for their preparation and to their use as pesticides and/or microbicides and/or herbicides. Moreover, the invention relates to novel selective herbicidal active compound combinations comprising both the 4-biphenyl-substituted 4-substituted pyrazolidine-3,5-diones and at least one crop plant compatibility-improving compound, which combinations can be used with particularly good results for the selective control of weeds in various crops of useful plants.

It is already known that certain phenyl-substituted 4-halopyrazolidine-3,5-diones (WO 99/20610) have acaricidal, insecticidal and/or herbicidal action.

However, in particular at low application rates and concentrations, the activity and the activity spectrum of these compounds are not always entirely satisfactory. Moreover, the compatibility with plants of these compounds in the crop plants is not always sufficient.

This invention now provides novel compounds of the formula (I)



in which

X represents halogen, alkyl, alkenyl, alkynyl, alkoxy, alkenyloxy, alkylthio, alkylsulphinyl, alkylsulphonyl, haloalkyl, haloalkoxy, haloalkenyloxy, nitro or cyano,

Y represents in each case optionally substituted aryl or hetaryl,

W and Z independently of one another represent hydrogen, halogen, alkyl, alkoxy, haloalkyl, haloalkoxy, nitro or cyano,

A represents hydrogen, in each case optionally substituted alkyl, alkenyl, alkoxyalkyl, polyalkoxyalkyl, alkylthioalkyl, saturated or unsaturated, optionally substituted cycloalkyl in which optionally at least one ring atom is replaced by a heteroatom, or represents in each case optionally halogen-, alkyl-, haloalkyl-, alkoxy-, haloalkoxy-, cyano- or nitro-substituted aryl, arylalkyl or hetaryl,

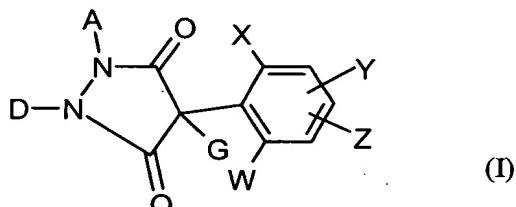
D represents hydrogen or an optionally substituted radical from the group consisting of alkyl and alkenyl,

A and D together with the atoms to which they are attached represent a saturated or unsaturated ring which optionally contains at least one heteroatom and which is unsubstituted or substituted in the A,D moiety,
5

G represents halogen or nitro.

Depending inter alia on the nature of the substituents, the compounds of the formula (I) can be present as geometrical and/or optical isomers or isomer mixtures of varying composition which, if appropriate, can be separated in a customary manner. The present invention provides both the pure isomers and the isomer mixtures, their preparation and use and compositions comprising them.
10 However, hereinbelow, for the sake of simplicity, only compounds of the formula (I) are referred to, although what is meant are both the pure compounds and, if appropriate, also mixtures having varying proportions of isomeric compounds.

A) Furthermore, it has been found that compounds of the formula (I)



15

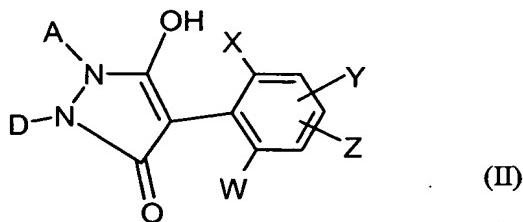
in which

A, D, W, X, Y and Z are as defined above

and

G represents halogen, preferably chlorine or bromine,

20 are obtained when compounds of the formula (II)

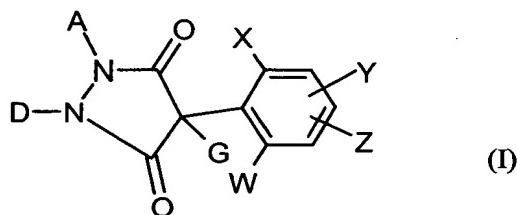


in which

A, D, W, X, Y and Z are as defined above

are reacted with halogenating agents in the presence of a solvent, and if appropriate, in the presence of a free-radical initiator.

- 5 B) Compounds of the formula (I)



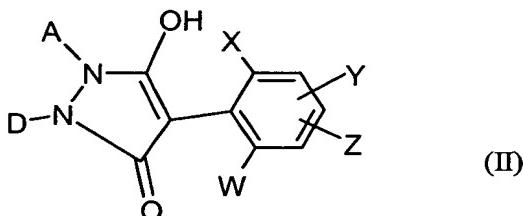
in which

A, D, W, X, Y and Z are as defined above

and

- 10 G represents nitro

are furthermore obtained when compounds of the formula (II)

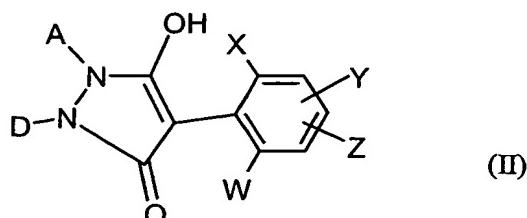


in which

A, D, W, X, Y and Z are as defined above

- 15 are reacted with nitrating agents, such as, for example, fuming nitric acid, in the presence of a solvent.

Some of the compounds, required for processes A and B, of the formula (II)



in which

A, D, W, X, Y and Z are as defined above

are known compounds (WO 99/43649, WO 99/48869, WO 99/55673, WO 01/17973) or they can

5 be synthesized by the processes described therein.

Suitable halogenating agents for process A are, for example, sulphuryl chloride, sulphuryl bromide, thionyl chloride, thionyl bromide, imides, such as, for example, N-bromosuccinimide or N-chlorosuccinimide, chlorosulphonic acid, and also hypochlorites, such as, for example, tert-butyl hypochlorite.

10 Suitable nitrating agents for process B are fuming nitric acid and also "nitrating acid mixtures".

Furthermore, it has been found that the novel compounds of the formula (I) are highly active pesticides, preferably insecticides and/or acaricides and/or microbicides, and/or herbicides.

Surprisingly, it has now also been found that certain substituted cyclic ketoenols, when used together with the crop plant compatibility-improving compounds (safeners/antidotes) described below, are
15 highly suitable for preventing damage to the crop plants and can be used particularly advantageously as broad-spectrum effective combination preparations for the selective control of unwanted plants in crops of useful plants, such as, for example, in cereals, but also maize, soybeans and rice.

The invention also provides selective herbicidal compositions comprising an effective amount of a combination of active compounds comprising the components

20 (a') at least one 4-biphenyl-substituted, 4-substituted pyrazolidine-3,5-dione derivative of the formula (I) in which A, D, G, W, X, Y and Z are as defined above,

and

(b') at least one crop plant compatibility-improving compound from the following group of compounds:

4-dichloroacetyl-1-oxa-4-azaspiro[4.5]decane (AD-67, MON-4660), 1-dichloroacetylhexahydro-3,3,8a-trimethylpyrrolo[1,2-a]pyrimidin-6(2H)-one (dicyclonon, BAS-145138), 4-dichloroacetyl-1-3,4-dihydro-3-methyl-2H-1,4-benzoxazine (benoxacor), 1-methylhexyl 5-chloroquinoline-8-oxyacetate (cloquintocet-mexyl - cf. also related compounds in EP-A-86750, EP-A-94349, 5 EP-A-191736, EP-A-492366), 3-(2-chlorobenzyl)-1-(1-methyl-1-phenylethyl)urea (cumyluron), α -(cyanomethoximino)phenylacetonitrile (cyometrinil), 2,4-dichlorophenoxyacetic acid (2,4-D), 4-(2,4-dichlorophenoxy)butyric acid (2,4-DB), 1-(1-methyl-1-phenylethyl)-3-(4-methylphenyl)urea (daimuron, dymron), 3,6-dichloro-2-methoxybenzoic acid (dicamba), S-1-methyl 1-phenylethyl piperidine-1-thiocarboxylate (dimepiperate), 2,2-dichloro-N-(2-oxo-2-(2-propenylamino)ethyl)-10 N-(2-propenyl)acetamide (DKA-24), 2,2-dichloro-N,N-di-2-propenylacetamide (dichlormid), 4,6-dichloro-2-phenylpyrimidine (fenclorim), ethyl 1-(2,4-dichlorophenyl)-5-trichloromethyl-1H-1,2,4-triazole-3-carboxylate (fenchlorazole-ethyl - cf. also related compounds in EP-A-174562 and EP-A-346620), phenylmethyl 2-chloro-4-trifluoromethylthiazole-5-carboxylate (flurazole), 4-chloro-N-(1,3-dioxolan-2-yl-methoxy)- α -trifluoroacetophenone oxime (fluxofenim), 3-dichloro-15 acetyl-5-(2-furanyl)-2,2-dimethyloxazolidine (furilazole, MON-13900), ethyl 4,5-dihydro-5,5-diphenyl-3-isoxazolecarboxylate (isoxadifen-ethyl - cf. also related compounds in WO-A-95/07897), 1-(ethoxycarbonyl)ethyl 3,6-dichloro-2-methoxybenzoate (lactidichlor), (4-chloro-o-tolyloxy)acetic acid (MCPA), 2-(4-chloro-o-tolyloxy)propionic acid (mecoprop), diethyl 1-(2,4-dichlorophenyl)-4,5-dihydro-5-methyl-1H-pyrazole-3,5-dicarboxylate (mefenpyr-20 diethyl -cf. also related compounds in WO-A-91/07874), 2-dichloromethyl-2-methyl-1,3-dioxolane (MG-191), 2-propenyl-1-oxa-4-azaspiro[4.5]decane-4-carbodithioate (MG-838), 1,8-naphthalic anhydride, α -(1,3-dioxolan-2-ylmethoximino)phenylacetonitrile (oxabetrinil), 2,2-dichloro-N-(1,3-dioxolan-2-yl-methyl)-N-(2-propenyl)acetamide (PPG-1292), 3-dichloroacetyl-2,2-di-25 methylloxazolidine (R-28725), 3-dichloroacetyl-2,2,5-trimethyloxazolidine (R-29148), 4-(4-chloro-o-tolyloxy)butyric acid, 4-(4-chlorophenoxy)butyric acid, diphenylmethoxyacetic acid, methyl diphenylmethoxyacetate, ethyl diphenylmethoxyacetate, methyl 1-(2-chlorophenyl)-5-phenyl-1H-pyrazole-3-carboxylate, ethyl 1-(2,4-dichlorophenyl)-5-methyl-1H-pyrazole-3-carboxylate, ethyl 1-(2,4-dichlorophenyl)-5-isopropyl-1H-pyrazole-3-carboxylate, ethyl 1-(2,4-dichlorophenyl)-5-(1,1-dimethylethyl)-1H-pyrazole-3-carboxylate, ethyl 1-(2,4-dichlorophenyl)-5-phenyl-30 1H-pyrazole-3-carboxylate (cf. also related compounds in EP-A-269806 and EP-A-333131), ethyl 5-(2,4-dichlorobenzyl)-2-isoxazoline-3-carboxylate, ethyl 5-phenyl-2-isoxazoline-3-carboxylate, ethyl 5-(4-fluorophenyl)-5-phenyl-2-isoxazoline-3-carboxylate (cf. also related compounds in WO-A-91/08202), 1,3-dimethylbut-1-yl 5-chloroquinoline-8-oxyacetate, 4-allyloxybutyl 5-chloroquinoline-8-oxyacetate, 1-allyloxyprop-2-yl 5-chloroquinoline-8-oxyacetate, methyl 5-chloroquinoxaline-8-oxyacetate, ethyl 5-chloroquinoline-8-oxyacetate, allyl 5-chloroquinoxaline-8-oxyacetate, 2-oxoprop-1-yl 5-chloroquinoline-8-oxyacetate, diethyl 5-chloroquinoline-8-oxymalonate, diallyl 5-chloroquinoxaline-8-oxymalonate, diethyl 5-chloroquinoline-8-oxy-35 malonate (cf. also related compounds in EP-A-582198), 4-carboxychroman-4-ylacetic acid

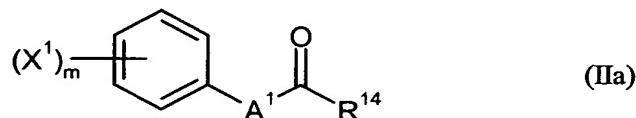
(AC-304415, cf. EP-A-613618), 4-chlorophenoxyacetic acid, 3,3'-dimethyl-4-methoxybenzophenone, 1-bromo-4-chloromethylsulphonylbenzene, 1-[4-(N-2-methoxybenzoyl-sulphamoyl)phenyl]-3-methylurea (also known as N-(2-methoxybenzoyl)-4-[(methylamino-carbonyl)amino]benzenesulphonamide), 1-[4-(N-2-methoxybenzoylsulphamoyl)phenyl]-3,3-dimethylurea, 1-[4-(N-4,5-dimethylbenzoylsulphamoyl)phenyl]-3-methylurea, 1-[4-(N-naphthyl-sulphamoyl)phenyl]-3,3-dimethylurea, N-(2-methoxy-5-methylbenzoyl)-4-(cyclopropylamino-carbonyl)benzenesulphonamide,

5

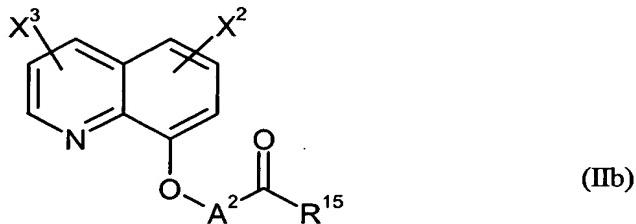
and/or one of the following compounds, defined by general formulae,

of the general formula (IIa)

10



or of the general formula (IIIb)



or of the formula (IIc)

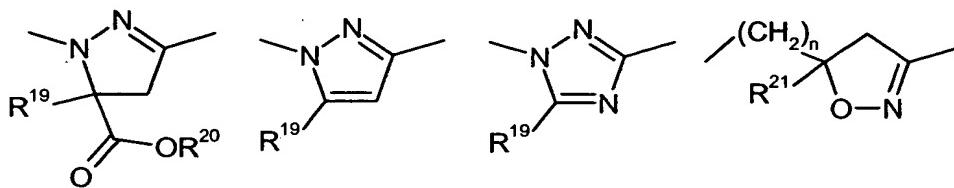


15

where

m represents a number 0, 1, 2, 3, 4 or 5,

A¹ represents one of the divalent heterocyclic groupings shown below



- n represents a number between 0 and 5,
- A² represents optionally C₁-C₄-alkyl- and/or C₁-C₄-alkoxy-carbonyl- and/or C₁-C₄-alkenyloxy-carbonyl-substituted alkanediyl having 1 or 2 carbon atoms,
- 5 R¹⁴ represents hydroxyl, mercapto, amino, C₁-C₆-alkoxy, C₁-C₆-alkylthio, C₁-C₆-alkylamino or di-(C₁-C₄-alkyl)-amino,
- R¹⁵ represents hydroxyl, mercapto, amino, C₁-C₇-alkoxy, C₁-C₆-alkenyloxy, C₁-C₆-alkenyloxy-C₁-C₆alkoxy, C₁-C₆-alkylthio, C₁-C₆-alkylamino or di-(C₁-C₄-alkyl)-amino,
- R¹⁶ represents in each case optionally fluorine-, chlorine- and/or bromine-substituted C₁-C₄-alkyl,
- 10 R¹⁷ represents hydrogen, in each case optionally fluorine-, chlorine- and/or bromine-substituted C₁-C₆-alkyl, C₂-C₆-alkenyl or C₂-C₆-alkynyl, C₁-C₄-alkoxy-C₁-C₄-alkyl, dioxolanyl-C₁-C₄-alkyl, furyl, furyl-C₁-C₄-alkyl, thienyl, thiazolyl, piperidinyl, or optionally fluorine-, chlorine- and/or bromine- or C₁-C₄-alkyl-substituted phenyl,
- R¹⁸ represents hydrogen, in each case optionally fluorine-, chlorine- and/or bromine-substituted C₁-C₆-alkyl, C₂-C₆-alkenyl or C₂-C₆-alkynyl, C₁-C₄-alkoxy-C₁-C₄-alkyl, dioxolanyl-C₁-C₄-alkyl, furyl, furyl-C₁-C₄-alkyl, thienyl, thiazolyl, piperidinyl, or optionally fluorine-, chlorine- and/or bromine- or C₁-C₄-alkyl-substituted phenyl, or together with R²⁷ and R¹⁸ represents C₃-C₆-alkanediyl or C₂-C₅-oxaalkanediyl, each of which is optionally substituted by C₁-C₄-alkyl, phenyl, furyl, a fused benzene ring or by two substituents which, together with the C atom to which they are attached, form a 5- or 6-membered carbocycle,
- 15 R¹⁹ represents hydrogen, cyano, halogen, or represents in each case optionally fluorine-, chlorine- and/or bromine-substituted C₁-C₄-alkyl, C₃-C₆-cycloalkyl or phenyl,
- R²⁰ represents hydrogen, optionally hydroxyl-, cyano-, halogen- or C₁-C₄-alkoxy-substituted C₁-C₆-alkyl, C₃-C₆-cycloalkyl or tri-(C₁-C₄-alkyl)-silyl,
- 20 R²¹ represents hydrogen, cyano, halogen, or represents in each case optionally fluorine-, chlorine- and/or bromine-substituted C₁-C₄-alkyl, C₃-C₆-cycloalkyl or phenyl,
- X¹ represents nitro, cyano, halogen, C₁-C₄-alkyl, C₁-C₄-haloalkyl, C₁-C₄-alkoxy or C₁-C₄-

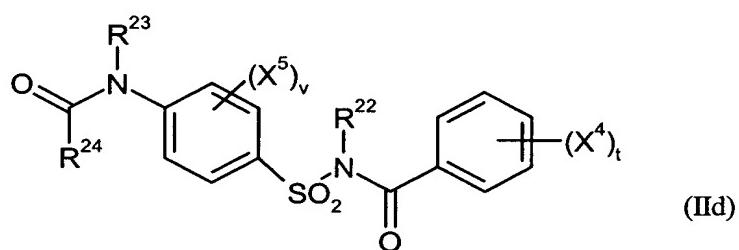
haloalkoxy,

X² represents hydrogen, cyano, nitro, halogen, C₁-C₄-alkyl, C₁-C₄-haloalkyl, C₁-C₄-alkoxy or C₁-C₄-haloalkoxy,

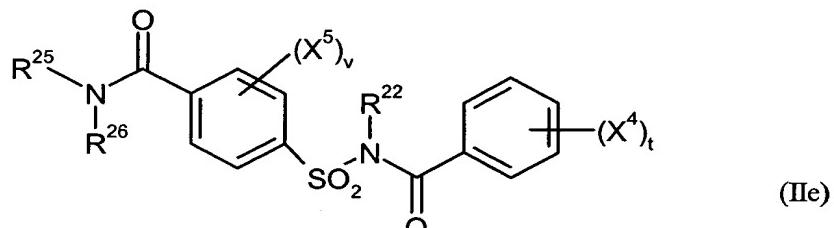
5 X³ represents hydrogen, cyano, nitro, halogen, C₁-C₄-alkyl, C₁-C₄-haloalkyl, C₁-C₄-alkoxy or C₁-C₄-haloalkoxy,

and/or the following compounds, defined by general formulae,

of the general formula (IId)



or the general formula (IIe)



10

where

t represents a number between 0 and 5,

v represents a number between 0 and 5,

R²² represents hydrogen or C₁-C₄-alkyl,

15 R²³ represents hydrogen or C₁-C₄-alkyl,

R²⁴ represents hydrogen, in each case optionally cyano-, halogen- or C₁-C₄-alkoxy-substituted C₁-C₆-alkyl, C₁-C₆-alkoxy, C₁-C₆-alkylthio, C₁-C₆-alkylamino or di-(C₁-C₄-alkyl)-amino, or in each case optionally cyano-, halogen- or C₁-C₄-alkyl-substituted C₃-C₆-cycloalkyl, C₃-C₆-cycloalkyloxy, C₃-C₆-cycloalkylthio or C₃-C₆-cycloalkylamino,

R²⁵ represents hydrogen, optionally cyano-, hydroxyl-, halogen- or C₁-C₄-alkoxy-substituted C₁-C₆-alkyl, in each case optionally cyano-, or halogen-substituted C₃-C₆-alkenyl or C₃-C₆-alkynyl, or optionally cyano-, halogen- or C₁-C₄-alkyl-substituted C₃-C₆-cycloalkyl,

R²⁶ represents hydrogen, optionally cyano-, hydroxyl-, halogen- or C₁-C₄-alkoxy-substituted C₁-C₆-alkyl, in each case optionally cyano- or halogen-substituted C₃-C₆-alkenyl or C₃-C₆-alkynyl, optionally cyano-, halogen- or C₁-C₄-alkyl-substituted C₃-C₆-cycloalkyl, or optionally nitro-, cyano-, halogen-, C₁-C₄-alkyl-, C₁-C₄-haloalkyl, C₁-C₄-alkoxy- or C₁-C₄-haloalkoxy-substituted phenyl, or together with R²⁵ represents in each case optionally C₁-C₄-alkyl-substituted C₂-C₆-alkanediyl or C₂-C₅-oxaalkanediyl,

10 X⁴ represents nitro, cyano, carboxyl, carbamoyl, formyl, sulphamoyl, hydroxyl, amino, halogen, C₁-C₄-alkyl, C₁-C₄-haloalkyl, C₁-C₄-alkoxy or C₁-C₄-haloalkoxy, and

X⁵ represents nitro, cyano, carboxyl, carbamoyl, formyl, sulphamoyl, hydroxyl, amino, halogen, C₁-C₄-alkyl, C₁-C₄-haloalkyl, C₁-C₄-alkoxy or C₁-C₄-haloalkoxy.

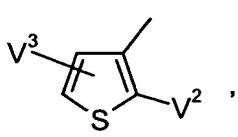
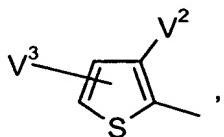
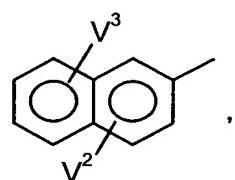
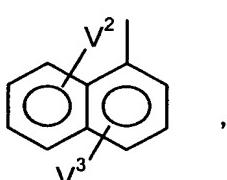
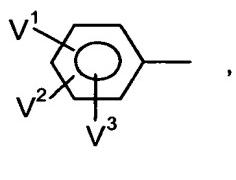
The formula (I) provides a general definition of the compounds according to the invention.

15 Preferred substituents or ranges of the radicals listed in the formulae given above and below are illustrated below:

W preferably represents hydrogen, halogen or C₁-C₆-alkyl,

X preferably represents halogen, C₁-C₆-alkyl, C₁-C₆-haloalkyl, C₁-C₆-alkoxy, C₁-C₆-haloalkoxy or cyano,

20 Y preferably represents one of the radicals



V¹ preferably represents hydrogen, halogen, C₁-C₁₂-alkyl, C₁-C₆-alkoxy, C₁-C₆-alkylthio, C₁-C₆-alkylsulphinyl, C₁-C₆-alkylsulphonyl, C₁-C₄-haloalkyl, C₁-C₄-haloalkoxy, nitro,

cyano or represents phenyl or phenoxy, each of which is optionally mono- or disubstituted by halogen, C₁-C₆-alkyl, C₁-C₆-alkoxy, C₁-C₄-haloalkyl, C₁-C₄-haloalkoxy, nitro or cyano,

V² and V³ independently of one another preferably represent hydrogen, halogen, C₁-C₆-Alkyl,

5 C₁-C₆-alkoxy, C₁-C₄-haloalkyl or C₁-C₄-haloalkoxy,

Z preferably represents hydrogen, halogen, C₁-C₆-alkyl, C₁-C₆-haloalkyl, C₁-C₆-alkoxy, C₁-C₆-haloalkoxy, nitro or cyano,

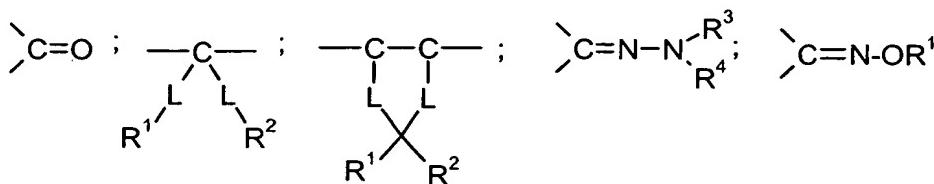
A preferably represents in each case optionally halogen-substituted C₁-C₁₂-alkyl, C₃-C₈-alkenyl, C₁-C₁₀-alkoxy-C₁-C₈-alkyl, poly-C₁-C₈-alkoxy-C₁-C₈-alkyl, C₁-C₁₀-alkylthio-C₁-C₆-alkyl, optionally halogen-, C₁-C₆-alkyl-, C₁-C₂-haloalkyl- or C₁-C₆-alkoxy-substituted C₃-C₈-cycloalkyl in which optionally one or two not directly adjacent ring members are replaced by oxygen and/or sulphur or represents phenyl or phenyl-C₁-C₆-alkyl, each of which is optionally substituted by halogen, C₁-C₆-alkyl, C₁-C₆-haloalkyl, C₁-C₆-alkoxy, C₁-C₆-haloalkoxy, cyano or nitro,

10 15 D preferably represents hydrogen, in each case optionally halogen-substituted C₁-C₁₂-alkyl or C₃-C₈-alkenyl,

A and D together preferably represent in each case optionally substituted C₃-C₆-alkanediyl or C₃-C₆-alkenediyl in which optionally one methylene group is replaced by oxygen or sulphur,

20 possible substituents being in each case:

hydroxyl, halogen, C₁-C₆-alkyl, C₁-C₄-haloalkyl, C₁-C₆-alkoxy or one of the following groups:



in which

25 L preferably represents oxygen or sulphur,

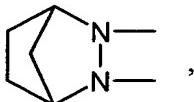
R¹, R² independently of one another preferably represent C₁-C₆-alkyl,

R³ preferably represents C₁-C₆-alkyl, C₁-C₆-haloalkyl, optionally halogen-, alkyl-, alkoxy-, haloalkyl-, haloalkoxy-, cyano- or nitro-substituted phenyl or represents the group CO₂R¹ or CON_—^{R¹_—^{R²,}}

R⁴ preferably represents hydrogen or C₁-C₄-alkyl

5

or represents the group



G preferably represents chlorine, bromine or nitro.

In the radical definitions mentioned as being preferred, halogen represents fluorine, chlorine, bromine and iodine, in particular fluorine, chlorine and bromine.

W particularly preferably represents hydrogen, chlorine, bromine or C₁-C₄-alkyl,

10 X particularly preferably represents fluorine, chlorine, bromine, C₁-C₄-alkyl, C₁-C₄-alkoxy, C₁-C₄-haloalkyl, C₁-C₄-haloalkoxy or cyano,

Y particularly preferably represents the radical



15 V¹ particularly preferably represents hydrogen, fluorine, chlorine, bromine, C₁-C₆-alkyl, C₁-C₆-alkylthio, C₁-C₆-alkylsulphonyl, C₁-C₄-alkoxy, C₁-C₂-haloalkyl, C₁-C₂-haloalkoxy, nitro or cyano, or represents phenyl or phenoxy, each of which is optionally monosubstituted by chlorine,

V² particularly preferably represents hydrogen, fluorine, chlorine, bromine, C₁-C₄-alkyl, C₁-C₄-alkoxy, C₁-C₂-haloalkyl or C₁-C₂-haloalkoxy,

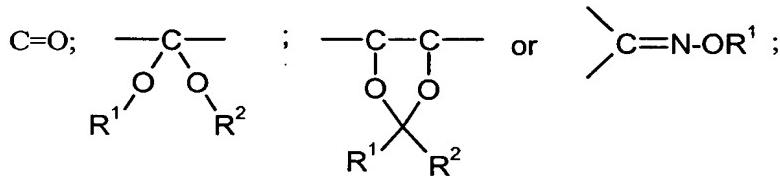
20 Z particularly preferably represents hydrogen, fluorine, chlorine, bromine, C₁-C₄-alkyl, C₁-C₂-haloalkyl, C₁-C₄-alkoxy or C₁-C₂-haloalkoxy,

A particularly preferably represents C₁-C₁₀-alkyl, C₃-C₆-alkenyl, C₁-C₈-alkoxy-C₁-C₆-

alkyl, each of which is optionally mono- to pentasubstituted by fluorine or chlorine, represents C₃-C₇-cycloalkyl which is optionally mono- or disubstituted by fluorine, chlorine, C₁-C₄-alkyl, trifluoromethyl or C₁-C₄-alkoxy and in which optionally one ring member is replaced by oxygen or sulphur or represents phenyl or phenyl-C₁-C₄-alkyl,
5 each of which is optionally mono- or disubstituted by fluorine, chlorine, bromine, C₁-C₄-alkyl, C₁-C₄-haloalkyl, C₁-C₄-alkoxy or C₁-C₄-haloalkoxy,

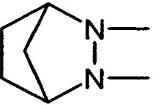
D particularly preferably represents hydrogen, represents C₁-C₈-alkyl or C₃-C₆-alkenyl, each of which is optionally mono- to pentasubstituted by fluorine or chlorine,

A and D together particularly preferably represent optionally substituted C₃-C₅-alkanediyl or C₃-C₅-alkenediyl in which optionally one methylene group may be replaced by oxygen or sulphur, possible substituents being hydroxyl, C₁-C₄-alkyl, C₁-C₄-alkoxy or the groups:
10



where

R¹ and R² independently of one another particularly preferably represent C₁-C₄-alkyl

15 or represent the group 

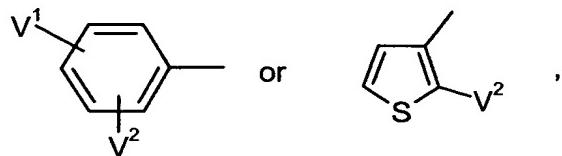
G particularly preferably represents chlorine, bromine or nitro.

In the radical definitions mentioned as being particularly preferred, halogen represents fluorine, chlorine, bromine and iodine, in particular fluorine, chlorine and bromine.

W very particularly preferably represents hydrogen, chlorine, methyl or ethyl,

20 X very particularly preferably represents chlorine, methyl, ethyl, n-propyl, isopropyl, methoxy, ethoxy, n-propoxy, isopropoxy, trifluoromethyl, difluoromethoxy, trifluoromethoxy or cyano,

Y very particularly preferably represents the radical



V¹ very particularly preferably represents hydrogen, fluorine, chlorine, bromine, methyl, ethyl, n-propyl, isopropyl, n-butyl, isobutyl, tert-butyl, methoxy, ethoxy, n-propoxy, isopropoxy, SO₂C₂H₅, SCH₃, trifluoromethyl, trifluoromethoxy, nitro, cyano, or represents phenoxy which is optionally monosubstituted by chlorine,

V² very particularly preferably represents hydrogen, fluorine, chlorine, methyl, ethyl, n-propyl, isopropyl, methoxy, ethoxy, trifluoromethyl or trifluoromethoxy,

Z very particularly preferably represents hydrogen, fluorine, chlorine or methyl,

A very particularly preferably represents C₁-C₆-alkyl, C₃-C₄-alkenyl C₁-C₂-alkoxy-C₁-C₂-alkyl or C₃-C₆-cycloalkyl,

D very particularly preferably represents hydrogen, methyl, ethyl or n-propyl,

A, D together very particularly preferably represent C₃-C₅-alkanediyl which is optionally substituted by fluorine and/or C₁-C₆-alkyl and in which optionally one carbon atom is replaced by oxygen,

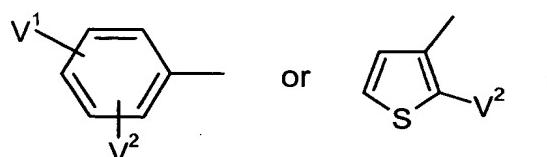
15 or represent the group

G very particularly preferably represents chlorine or bromine, especially preferably chlorine,

W most preferably represents hydrogen, methyl or ethyl,

X most preferably represents chlorine, methyl or ethyl,

Y most preferably represents the radical



v¹ most preferably represents hydrogen, fluorine, chlorine, methyl, isopropyl, methoxy, SO₂C₂H₅, SCH₃, trifluoromethyl, trifluoromethoxy, nitro, or represents phenoxy which is optionally monosubstituted by chlorine,

v² most preferably represents hydrogen, fluorine, chlorine, methoxy or trifluoromethyl,

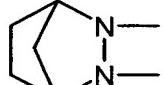
5 Z most preferably represents hydrogen or methyl,

A most preferably represents C₁-C₆-alkyl,

D most preferably represents methyl or ethyl, or

A, D together most preferably represent optionally fluorine- and/or methyl-substituted C₃-C₅-alkanediyl in which optionally one carbon atom is replaced by oxygen

10

or represent the group  ,

G represents chlorine.

The general or preferred radical definitions or illustrations listed above can be combined with one another as desired, i.e. including combinations between the respective ranges and preferred ranges. They apply to the end products and, correspondingly, to the precursors and intermediates.

15

Preference according to the invention is given to the compounds of the formula (I) which contain a combination of the meanings listed above as being preferred (preferable).

Particular preference according to the invention is given to the compounds of the formula (I) which contain a combination of the meanings listed above as being particularly preferred.

20

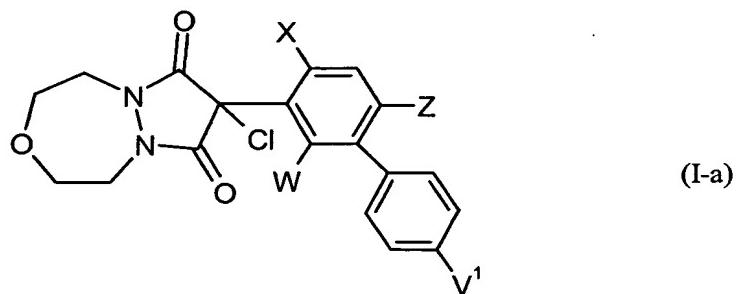
Very particular preference according to the invention is given to the compounds of the formula (I) which contain a combination of the meanings listed above as being very particularly preferred.

Saturated or unsaturated hydrocarbon radicals, such as alkyl or alkenyl, can in each case be straight-chain or branched as far as this is possible, including in combination with heteroatoms, such as, for example, in alkoxy.

25

Unless indicated otherwise, optionally substituted radicals can be mono- or polysubstituted, where in the case of polysubstitutions the substituents can be identical or different.

In addition to the compounds mentioned in the Preparation Examples, the following compounds of the formula (I) may be specifically mentioned:

**Table 1:**

| W | X | Z | V¹ |
|-----------------|-----------------|-----------------|----------------------|
| CH ₃ | CH ₃ | H | F |
| CH ₃ | CH ₃ | H | Cl |
| CH ₃ | CH ₃ | CH ₃ | CF ₃ |
| H | CH ₃ | CH ₃ | F |
| H | CH ₃ | CH ₃ | Cl |
| H | CH ₃ | CH ₃ | CF ₃ |
| CH ₃ | CH ₃ | CH ₃ | F |
| CH ₃ | CH ₃ | CH ₃ | Cl |
| CH ₃ | CH ₃ | CH ₃ | CF ₃ |
| H | 2-Cl | H | F |
| H | 2-Cl | H | Cl |
| H | 2-Cl | H | CF ₃ |

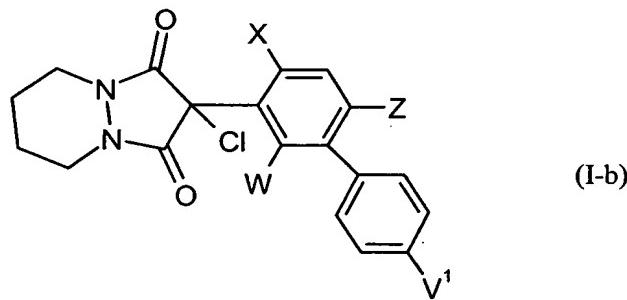
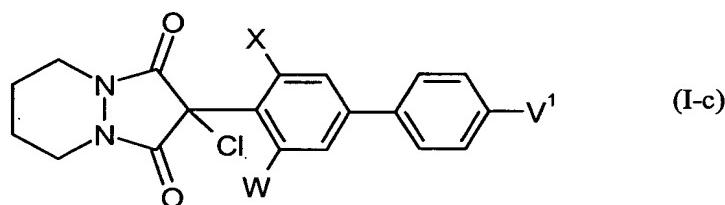


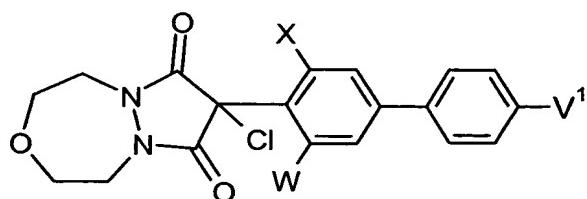
Table 2:

| W | X | Z | V |
|-----------------|-----------------|-----------------|-----------------|
| CH ₃ | CH ₃ | H | F |
| CH ₃ | CH ₃ | H | Cl |
| CH ₃ | CH ₃ | H | CF ₃ |
| H | CH ₃ | CH ₃ | F |
| H | CH ₃ | CH ₃ | Cl |
| H | CH ₃ | CH ₃ | CF ₃ |
| CH ₃ | CH ₃ | CH ₃ | F |
| CH ₃ | CH ₃ | CH ₃ | Cl |
| CH ₃ | CH ₃ | CH ₃ | CF ₃ |
| H | 2-Cl | H | F |
| H | 2-Cl | H | Cl |
| H | 2-Cl | H | CF ₃ |

**Table 3:**

| W | X | V |
|-----------------|-------------------------------|-----------------|
| CH ₃ | CH ₃ | Cl |
| CH ₃ | CH ₃ | F |
| CH ₃ | CH ₃ | CF ₃ |
| H | CH ₃ | Cl |
| H | CH ₃ | F |
| CH ₃ | C ₂ H ₅ | Cl |
| CH ₃ | C ₂ H ₅ | F |
| CH ₃ | C ₂ H ₅ | CF ₃ |
| CH ₃ | Cl | Cl |
| CH ₃ | Cl | F |
| CH ₃ | Cl | CF ₃ |

| W | X | VI |
|-------------------------------|-------------------------------|-----------------|
| C ₂ H ₅ | Cl | Cl |
| C ₂ H ₅ | Cl | F |
| C ₂ H ₅ | Cl | CF ₃ |
| C ₂ H ₅ | C ₂ H ₅ | Cl |
| C ₂ H ₅ | C ₂ H ₅ | F |
| C ₂ H ₅ | C ₂ H ₅ | CF ₃ |

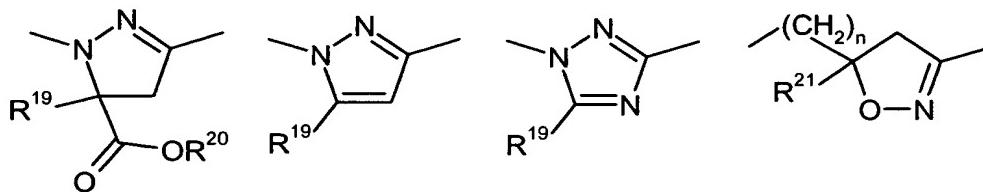
**Table 4:**

| W | X | VI |
|-------------------------------|-------------------------------|-----------------|
| CH ₃ | CH ₃ | Cl |
| CH ₃ | CH ₃ | F |
| CH ₃ | CH ₃ | CF ₃ |
| H | CH ₃ | Cl |
| H | CH ₃ | F |
| H | CH ₃ | CF ₃ |
| CH ₃ | C ₂ H ₅ | Cl |
| CH ₃ | C ₂ H ₅ | F |
| CH ₃ | C ₂ H ₅ | CF ₃ |
| CH ₃ | Cl | Cl |
| CH ₃ | Cl | F |
| CH ₃ | Cl | CF ₃ |
| C ₂ H ₅ | Cl | Cl |
| C ₂ H ₅ | Cl | F |
| C ₂ H ₅ | Cl | CF ₃ |
| C ₂ H ₅ | C ₂ H ₅ | Cl |
| C ₂ H ₅ | C ₂ H ₅ | F |
| C ₂ H ₅ | C ₂ H ₅ | CF ₃ |

Preferred meanings of the groups listed above in connection with the crop plant compatibility-improving compounds ("herbicide safeners") of the formulae (IIa), (IIb), (IIc), (IId) and (IIe) are defined below.

m preferably represents the numbers 0, 1, 2, 3 or 4.

5 A¹ preferably represents one of the divalent heterocyclic groupings shown below



n preferably represents the number 0, 1, 2, 3 or 4.

A² preferably represents in each case optionally methyl-, ethyl-, methoxycarbonyl- or ethoxycarbonyl- or allyloxycarbonyl -substituted methylene or ethylene.

10 R¹⁴ preferably represents hydroxyl, mercapto, amino, methoxy, ethoxy, n- or i-propoxy, n-, i-, s- or t-butoxy, methylthio, ethylthio, n- or i-propylthio, n-, i-, s- or t-butylthio, methylamino, ethylamino, n- or i-propylamino, n-, i-, s- or t-butylamino, dimethylamino or diethylamino,

R¹⁵ preferably represents hydroxyl, mercapto, amino, methoxy, ethoxy, n- or i-propoxy, n-, i-, s- or t-butoxy, 1-methylhexyloxy, allyloxy, 1-allyloxymethylethoxy, methylthio, ethylthio, n- or i-propylthio, n-, i-, s- or t-butylthio, methylamino, ethylamino, n- or i-propylamino, n-, i-, s- or t-butylamino, dimethylamino or diethylamino.

R¹⁶ preferably represents in each case optionally fluorine, chlorine, and/or bromine-substituted methyl, ethyl, n- or i-propyl.

20 R¹⁷ preferably represents hydrogen, in each case optionally fluorine and/or chlorine-substituted methyl, ethyl, n- or i-propyl, n-, i-, s- or t-butyl, propenyl, butenyl, propynyl or butynyl, methoxymethyl, ethoxymethyl, methoxyethyl, ethoxyethyl, dioxolanylmethyl, furyl, furylmethyl, thienyl, thiazolyl, piperidinyl, or optionally fluorine-, chlorine-, methyl-, ethyl-, n- or i-propyl, n-, i-, s- or t-butyl-substituted phenyl.

25 R¹⁸ preferably represents hydrogen, in each case optionally fluorine- and/or chlorine-substituted methyl, ethyl, n- or i-propyl, n-, i-, s- or t-butyl, propenyl, butenyl, propynyl or butynyl, methoxymethyl, ethoxymethyl, methoxyethyl, ethoxyethyl, dioxolanylmethyl, furyl, furylmethyl, thienyl, thiazolyl, piperidinyl, or optionally fluorine-, chlorine-, methyl-, ethyl-, n- or i-propyl, n-, i-, s- or t-butyl-substituted phenyl, or together with R¹⁷ represents one of the

radicals $-\text{CH}_2\text{-O-CH}_2\text{-CH}_2-$ and $-\text{CH}_2\text{-CH}_2\text{-O-CH}_2\text{-CH}_2-$ which are optionally substituted by methyl, ethyl, furyl, phenyl, a fused benzene ring or by two substituents which, together with the C atom to which they are attached, form a 5- or 6-membered carbocycle.

- 5 R^{19} preferably represents hydrogen, cyano, fluorine, chlorine, bromine, or represents in each case optionally, fluorine-, chlorine- and/or bromine-substituted methyl, ethyl, n- or i-propyl, cyclopropyl, cyclobutyl, cyclopentyl, cyclohexyl or phenyl.
- 10 R^{20} preferably represents hydrogen, optionally hydroxyl-, cyano-, fluorine-, chlorine-, methoxy-, ethoxy-, n- or i-propoxy-substituted methyl, ethyl, n- or i-propyl, n-, i-, s- or t-butyl.
- 15 R^{21} preferably represents hydrogen, cyano, fluorine, chlorine, bromine, or represents in each case optionally fluorine-, chlorine- and/or bromine-substituted methyl, ethyl, n- or i-propyl, n-, i-, s- or t-butyl, cyclopropyl, cyclobutyl, cyclopentyl, cyclohexyl or phenyl.
- 15 X^1 preferably represents nitro, cyano, fluorine, chlorine, bromine, methyl, ethyl, n- or i-propyl, n-, i-, s- or t-butyl, difluoromethyl, dichloromethyl, trifluoromethyl, trichloromethyl, chlorodifluoromethyl, fluorodichloromethyl, methoxy, ethoxy, n- or i-propoxy, difluoromethoxy or trifluoromethoxy.
- 20 X^2 preferably represents hydrogen, nitro, cyano, fluorine, chlorine, bromine, methyl, ethyl, n- or i-propyl, n-, i-, s- or t-butyl, difluoromethyl, dichloromethyl, trifluoromethyl, trichloromethyl, chlorodifluoromethyl, fluorodichloromethyl, methoxy, ethoxy, n- or i-propoxy, difluoromethoxy or trifluoromethoxy.
- 25 X^3 preferably represents hydrogen, nitro, cyano, fluorine, chlorine, bromine, methyl, ethyl, n- or i-propyl, n-, i-, s- or t-butyl, difluoromethyl, dichloromethyl, trifluoromethyl, trichloromethyl, chlorodifluoromethyl, fluorodichloromethyl, methoxy, ethoxy, n- or i-propoxy, difluoromethoxy or trifluoromethoxy.
- 25 v preferably represents the number 0, 1, 2, 3 or 4.
- 25 t preferably represents the number 0, 1, 2, 3 or 4.
- 25 R^{22} preferably represents hydrogen, methyl, ethyl, n- or i-propyl.
- 25 R^{23} preferably represents hydrogen, methyl, ethyl, n- or i-propyl.
- 30 R^{24} preferably represents hydrogen, in each case optionally cyano-, fluorine-, chlorine-, methoxy-, ethoxy-, n- or i-propoxy-substituted methyl, ethyl, n- or i-propyl, n-, i-, s- or t-butyl, methoxy, ethoxy, n- or i-propoxy, n-, i-, s- or t-butoxy, methylthio, ethylthio, n- or

5 i-propylthio, n-, i-, s- or t-butylthio, methylamino, ethylamino, n- or i-propylamino, n-, i-, s- or t-butylamino, dimethylamino or diethylamino, or in each case optionally cyano-, fluorine-, chlorine-, bromine-, methyl-, ethyl-, n- or i-propyl-substituted cyclopropyl, cyclobutyl, cyclopentyl, cyclohexyl, cyclopropyloxy, cyclobutyloxy, cyclopentyloxy, cyclohexyloxy, cyclopropylthio, cyclobutylthio, cyclopentylthio, cyclohexylthio, cyclopropylamino, cyclobutylamino, cyclopentylamino or cyclohexylamino.

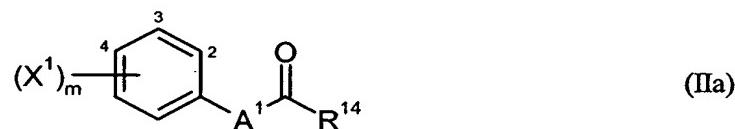
10 R²⁵ preferably represents hydrogen, in each case optionally cyano-, hydroxyl-, fluorine-, chlorine-, methoxy-, ethoxy-, n- or i-propoxy-substituted methyl, ethyl, n- or i-propyl, n-, i- or s-butyl, in each case optionally cyano-, fluorine-, chlorine- or bromine-substituted propenyl, butenyl, propynyl or butynyl, or in each case optionally cyano-, fluorine-, chlorine-, bromine-, methyl-, ethyl-, n- or i-propyl-substituted cyclopropyl, cyclobutyl, cyclopentyl or cyclohexyl.

15 R²⁶ preferably represents hydrogen, in each case optionally cyano-, hydroxyl-, fluorine-, chlorine-, methoxy-, ethoxy-, n- or i-propoxy-substituted methyl, ethyl, n- or i-propyl, n-, i- or s-butyl, in each case optionally cyano-, fluorine-, chlorine- or bromine-substituted propenyl, butenyl, propynyl or butynyl, in each case optionally cyano-, fluorine-, chlorine-, bromine-, methyl-, ethyl-, n- or i-propyl-substituted cyclopropyl, cyclobutyl, cyclopentyl or cyclohexyl, or optionally nitro-, cyano-, fluorine-, chlorine-, bromine-, methyl-, ethyl-, n- or i-propyl-, n-, i-, s- or t-butyl-, trifluoromethyl-, methoxy-, ethoxy-, n- or i-propoxy-, difluoromethoxy- or trifluoromethoxy-substituted phenyl, or together with R²⁵ represents in each case optionally methyl- or ethyl-substituted butane-1,4-diyl (trimethylene), pentane-1,5-diyl, 1-oxabutane-1,4-diyl or 3-oxapentane-1,5-diyl.

20 X⁴ preferably represents nitro, cyano, carboxyl, carbamoyl, formyl, sulphamoyl, hydroxyl, amino, fluorine, chlorine, bromine, methyl, ethyl, n- or i-propyl, n-, i-, s- or t-butyl, trifluoromethyl, methoxy, ethoxy, n- or i-propoxy, difluoromethoxy or trifluoromethoxy.

25 X⁵ preferably represents nitro, cyano, carboxyl, carbamoyl, formyl, sulphamoyl, hydroxyl, amino, fluorine, chlorine, bromine, methyl, ethyl, n- or i-propyl, n-, i-, s- or t-butyl, trifluoromethyl, methoxy, ethoxy, n- or i-propoxy, difluoromethoxy or trifluoromethoxy.

30 Examples of the compounds of the formula (IIa) which are very particularly preferred as herbicide safeners according to the invention are listed in Table 2 below.

Table 2: Examples of the compounds of the formula (IIa)

| Example No. | (positions) (X¹)ₘ | A¹ | R¹⁴ |
|-------------|----------------------|----|--------------------------------|
| IIa-1 | (2) Cl, (4) Cl | | OCH ₃ |
| IIa-2 | (2) Cl, (4) Cl | | OCH ₃ |
| IIa-3 | (2) Cl, (4) Cl | | OC ₂ H ₅ |
| IIa-4 | (2) Cl, (4) Cl | | OC ₂ H ₅ |
| IIa-5 | (2) Cl | | OCH ₃ |
| IIa-6 | (2) Cl, (4) Cl | | OCH ₃ |

| Example No. | (positions) (X^1_m) | A^1 | R^{14} |
|-------------|-----------------------------|-------|--------------------------------|
| IIa-7 | (2) F | | OCH ₃ |
| IIa-8 | (2) F | | OCH ₃ |
| IIa-9 | (2) Cl, (4) Cl | | OC ₂ H ₅ |
| IIa-10 | (2) Cl, (4) CF ₃ | | OCH ₃ |
| IIa-11 | (2) Cl | | OCH ₃ |
| IIa-12 | - | | OC ₂ H ₅ |
| IIa-13 | (2) Cl, (4) Cl | | OC ₂ H ₅ |

| Example No. | (positions) (X¹)_m | A¹ | R¹⁴ |
|--------------------|--|----------------------|--------------------------------|
| IIa-14 | (2) Cl, (4) Cl | | OC ₂ H ₅ |
| IIa-15 | (2) Cl, (4) Cl | | OC ₂ H ₅ |
| IIa-16 | (2) Cl, (4) Cl | | OC ₂ H ₅ |
| IIa-17 | (2) Cl, (4) Cl | | OC ₂ H ₅ |
| IIa-18 | - | | OH |

Examples of the formula (IIb) which are very particularly preferred as herbicide safeners according to the invention are listed in Table 3 below.

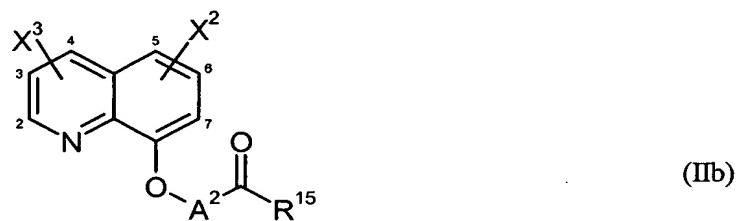


Table 3: Examples of the compounds of the formula (IIb)

| Example No. | (position) X² | (position) X³ | A² | R¹⁵ |
|--------------------|---------------------------------|---------------------------------|----------------------|---|
| IIb-1 | (5) Cl | - | CH ₂ | OH |
| IIb-2 | (5) Cl | - | CH ₂ | OCH ₃ |
| IIb-3 | (5) Cl | - | CH ₂ | OC ₂ H ₅ |
| IIb-4 | (5) Cl | - | CH ₂ | OC ₃ H _{7-n} |
| IIb-5 | (5) Cl | - | CH ₂ | OC ₃ H _{7-i} |
| IIb-6 | (5) Cl | - | CH ₂ | OC ₄ H _{9-n} |
| IIb-7 | (5) Cl | - | CH ₂ | OCH(CH ₃)C ₅ H _{11-n} |
| IIb-8 | (5) Cl | (2) F | CH ₂ | OH |
| IIb-9 | (5) Cl | (2) Cl | CH ₂ | OH |
| IIb-10 | (5) Cl | - | CH ₂ | OCH ₂ CH=CH ₂ |
| IIb-11 | (5) Cl | - | CH ₂ | OC ₄ H _{9-i} |

| Example No. | (position) X ² | (position) X ³ | A ² | R ¹⁵ |
|-------------|---------------------------|---------------------------|-----------------|-------------------------------------|
| IIb-12 | (5) Cl | - | CH ₂ | |
| IIb-13 | (5) Cl | - | | OCH ₂ CH=CH ₂ |
| IIb-14 | (5) Cl | - | | OC ₂ H ₅ |
| IIb-15 | (5) Cl | - | | OCH ₃ |

Examples of the formula (IIc) which are very particularly preferred as herbicide safeners according to the invention are listed in Table 4 below.

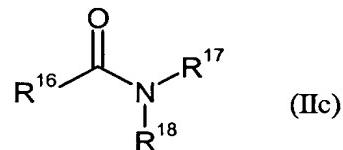
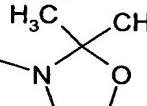
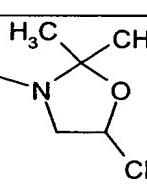
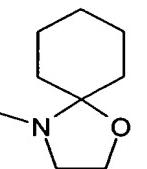
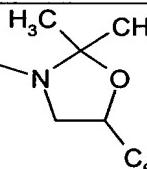
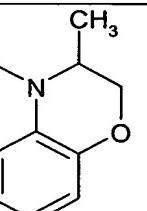
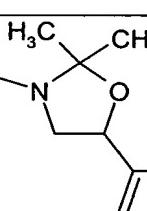


Table 4: Examples of the compounds of the formula (IIc)

| Example No. | R^{16} | $\text{N}(\text{R}^{17}, \text{R}^{18})$ |
|-------------|-----------------|---|
| IIc-1 | CHCl_2 | $\text{N}(\text{CH}_2\text{CH}=\text{CH}_2)_2$ |
| IIc-2 | CHCl_2 |  |
| IIc-3 | CHCl_2 |  |
| IIc-4 | CHCl_2 |  |
| IIc-5 | CHCl_2 |  |
| IIc-6 | CHCl_2 |  |
| IIc-7 | CHCl_2 |  |

Examples of the formula (IId) which are very particularly preferred as herbicide safeners according to

the invention are listed in Table 5 below.

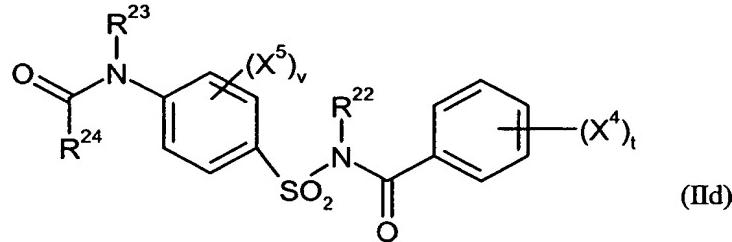
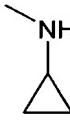


Table 5: Examples of the compounds of the formula (IId)

| Example No. | R ²² | R ²³ | R ²⁴ | (positions) (X ⁴) _t | (positions) (X ⁵) _v |
|-------------|-----------------|-----------------|-----------------------------------|---|--|
| IIId-1 | H | H | CH ₃ | (2) OCH ₃ | - |
| IIId-2 | H | H | C ₂ H ₅ | (2) OCH ₃ | - |
| IIId-3 | H | H | C ₃ H ₇ -n | (2) OCH ₃ | - |
| IIId-4 | H | H | C ₃ H ₇ -i | (2) OCH ₃ | - |
| IIId-5 | H | H | | (2) OCH ₃ | - |
| IIId-6 | H | H | CH ₃ | (2) OCH ₃ (5) CH ₃ | - |
| IIId-7 | H | H | C ₂ H ₅ | (2) OCH ₃ (5) CH ₃ | - |
| IIId-8 | H | H | C ₃ H ₇ -n | (2) OCH ₃ (5) CH ₃ | - |
| IIId-9 | H | H | C ₃ H ₇ -i | (2) OCH ₃ (5) CH ₃ | - |
| IIId-10 | H | H | | (2) OCH ₃ (5) CH ₃ | - |
| IIId-11 | H | H | OCH ₃ | (2) OCH ₃ (5) CH ₃ | - |
| IIId-12 | H | H | OC ₂ H ₅ | (2) OCH ₃ (5) CH ₃ | - |
| IIId-13 | H | H | OC ₃ H ₇ -i | (2) OCH ₃ (5) CH ₃ | - |

| Example No. | R^{22} | R^{23} | R^{24} | (positions) $(X^4)_t$ | (positions) $(X^5)_v$ |
|-------------|----------|----------|--|---|-----------------------|
| IId-14 | H | H | SCH ₃ | (2) OCH ₃ (5) CH ₃ | - |
| IId-15 | H | H | SC ₂ H ₅ | (2) OCH ₃ (5) CH ₃ | - |
| IId-16 | H | H | SC ₃ H _{7-i} | (2) OCH ₃ (5) CH ₃ | - |
| IId-17 | H | H | NHCH ₃ | (2) OCH ₃ (5) CH ₃ | - |
| IId-18 | H | H | NHC ₂ H ₅ | (2) OCH ₃ (5) CH ₃ | - |
| IId-19 | H | H | NHC ₃ H _{7-i} | (2) OCH ₃ (5) CH ₃ | - |
| IId-20 | H | H |  | (2) OCH ₃ (5) CH ₃ | - |
| IId-21 | H | H | NHCH ₃ | (2) OCH ₃ | - |
| IId-22 | H | H | NHC ₃ H _{7-i} | (2) OCH ₃ | - |
| IId-23 | H | H | N(CH ₃) ₂ | (2) OCH ₃ | - |
| IId-24 | H | H | N(CH ₃) ₂ | (3) CH ₃ (4) CH ₃ | - |
| IId-25 | H | H | CH ₂ -O-CH ₃ | (2) OCH ₃ | - |

Examples of the formula (IIe) which are very particularly preferred as herbicide safeners according to the invention are listed in Table 6 below.

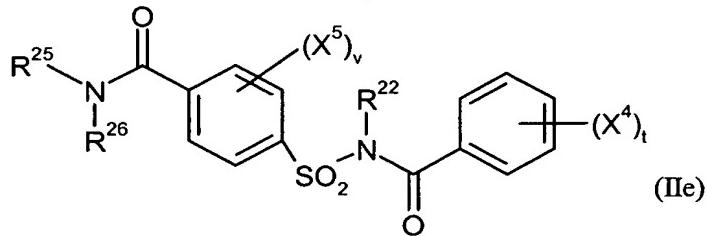


Table 6: Examples of the compounds of the formula (IIe)

| Example No. | \mathbf{R}^{22} | \mathbf{R}^{25} | \mathbf{R}^{26} | (positions) $(\mathbf{X}^4)_t$ | (positions) $(\mathbf{X}^5)_v$ |
|-------------|-------------------|-------------------|---|---|--------------------------------|
| IIe-1 | H | H | CH ₃ | (2) OCH ₃ | - |
| IIe-2 | H | H | C ₂ H ₅ | (2) OCH ₃ | - |
| IIe-3 | H | H | C ₃ H _{7-n} | (2) OCH ₃ | - |
| IIe-4 | H | H | C ₃ H _{7-i} | (2) OCH ₃ | - |
| IIe-5 | H | H |  | (2) OCH ₃ | - |
| IIe-6 | H | CH ₃ | CH ₃ | (2) OCH ₃ | - |
| IIe-7 | H | H | CH ₃ | (2) OCH ₃ (5) CH ₃ | - |
| IIe-8 | H | H | C ₂ H ₅ | (2) OCH ₃ (5) CH ₃ | - |
| IIe-9 | H | H | C ₃ H _{7-n} | (2) OCH ₃ (5) CH ₃ | - |
| IIe-10 | H | H | C ₃ H _{7-i} | (2) OCH ₃ (5) CH ₃ | - |
| IIe-11 | H | H |  | (2) OCH ₃ (5) CH ₃ | - |
| IIe-12 | H | CH ₃ | CH ₃ | (2) OCH ₃ (5) CH ₃ | - |

Most preferred as crop plant compatibility-improving compounds [component (b)] are cloquintocet-mexyl, fenchlorazole-ethyl, isoxadifen-ethyl, mefenpyr-diethyl, furilazole, fenclorim, cumyluron, dymron, dimepiperate and the compounds IIe-5 and IIe-11, and particular emphasis is given to cloquintocet-mexyl and mefenpyr-diethyl.

The compounds of the general formula (IIa) to be used as safeners according to the invention are known and/or can be prepared by processes known per se (cf. WO-A-91/07874, WO-A-95/07897).

The compounds of the general formula (IIb) to be used as safeners according to the invention are known and/or can be prepared by processes known per se (cf. EP-A-191736).

The compounds of the general formula (IIc) to be used as safeners according to the invention are known and/or can be prepared by processes known per se (cf. DE-A-2218097, DE-A-2350547).

The compounds of the general formula (IId) to be used as safeners according to the invention are known and/or can be prepared by processes known per se (cf. DE-A-19621522/US-A-6235680).

- 5 The compounds of the general formula (IIe) to be used as safeners according to the invention are known and can be prepared by processes known per se (cf. WO-A-99/66795/US-A-6251827).

Examples of the selective herbicidal combinations according to the invention comprising in each case one active compound of the formula (I) and one of the safeners defined above are listed in Table 7 below.

10 **Table 7:** Examples of the combinations according to the invention

| Active compounds of the formula (I) | Safeners |
|--|---------------------|
| I-a | cloquintocet-mexyl |
| I-a | fenchlorazole-ethyl |
| I-a | isoxadifen-ethyl |
| I-a | mefenpyr-diethyl |
| I-a | furilazole |
| I-a | fenclorim |
| I-a | cumyluron |
| I-a | daimuron /dymron |
| I-a | dimepiperate |
| I-a | IIe-11 |
| I-a | IIe-5 |
| I-b | cloquintocet-mexyl |
| I-b | fenchlorazole-ethyl |
| I-b | isoxadifen-ethyl |
| I-b | mefenpyr-diethyl |
| I-b | furilazole |
| I-b | fenclorim |
| I-b | cumyluron |
| I-b | daimuron /dymron |
| I-b | dimepiperate |
| I-b | IIe-11 |
| I-b | IIe-5 |

| Active compounds of the formula (I) | Safeners |
|-------------------------------------|---------------------|
| I-c | cloquintocet-mexyl |
| I-c | fenchlorazole-ethyl |
| I-c | isoxadifen-ethyl |
| I-c | mefenpyr-diethyl |
| I-c | furilazole |
| I-c | fenclorim |
| I-c | cumyluron |
| I-c | daimuron /dymron |
| I-c | dimepiperate |
| I-c | IIe-5 |
| I-c | IIe-11 |
| I-d | cloquintocet-mexyl |
| I-d | fenchlorazole-ethyl |
| I-d | isoxadifen-ethyl |
| I-d | mefenpyr-diethyl |
| I-d | furilazole |
| I-d | fenclorim |
| I-d | cumyluron |
| I-d | daimuron /dymron |
| I-d | dimepiperate |
| I-d | IIe-11 |
| I-d | IIe-5 |

Surprisingly, it has now been found that the active compound combinations defined above of 4-biphenyl-substituted 4-substituted pyrazolidine-3,5-diones of the general formula (I) and safeners (antidotes) from the group (b') listed above, while having very good compatibility with useful plants, have a particularly high herbicidal activity and can be used in various crops, in particular in cereals (especially wheat), but also in soybeans, potatoes, maize and rice, for the selective control of weeds.

5

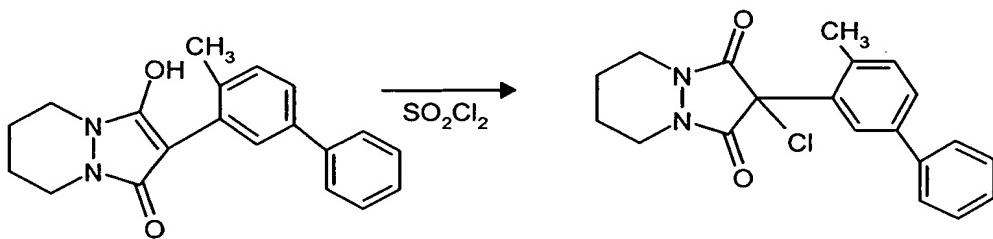
10

Here, it has to be considered to be surprising that, from the large number of known safeners or antidotes capable of antagonising the damaging effect of a herbicide on the crop plants, they are in particular the compounds of group (b') listed above which are suitable to compensate the damaging effect of 4-biphenyl-substituted 4-substituted pyrazolidine-3,5-diones on the crop plants

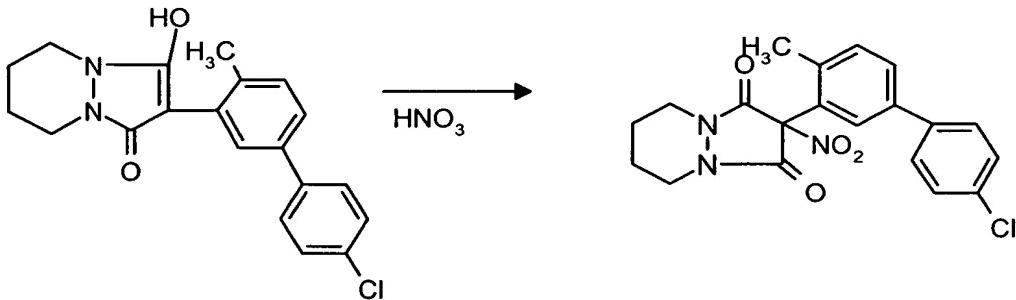
almost completely, without negatively effecting the herbicidal activity against the weeds to any considerable extent.

Emphasis may be given here to the particularly advantageous effect of the particularly preferred and most preferred combination partners from group (b'), in particular with respect to sparing cereal plants, such as, for example, wheat, barley and rye, but also maize and rice, as crop plants.

Using, according to process (A), 4-[(2-methyl-5-phenyl)phenyl]-1,2-tetramethylene-5-hydroxy- Δ^4 -pyrazolidin-3-one as starting material, the course of the process according to the invention can be represented by the following reaction scheme:



Using, according to process (B), 4-[(2-methyl-5-(4-chlorophenyl)phenyl]-1,2-tetramethylene-5-hydroxy- Δ^4 -pyrazolidin-3-one, the course of the process according to the invention can be represented by the following reaction scheme:



Process (A) is characterized in that compounds of the formula (II) in which A, D, W, X, Y and Z are as defined above are reacted in the presence of a diluent and a halogenating agent and, if appropriate, a free-radical initiator. Suitable free-radical initiators are, for example, benzoyl peroxide or azobisisobutyronitrile.

Suitable diluents for the process (A) according to the invention are all inert organic solvents. Preference is given to using hydrocarbons, such as benzene, toluene and xylene, furthermore ethers, such as dibutyl ether, tetrahydrofuran, dioxane, glycol dimethyl ether and diglycol dimethyl ether, moreover halogenated hydrocarbons, such as dichloromethane, chloroform, carbon

tetrachloride, dichloroethane, chlorobenzene, dichlorobenzene, and also esters, such as ethyl acetate.

Suitable halogenating agents for process A are, for example, sulphuryl chloride, sulphuryl bromide, thionyl chloride, thionyl bromide, imides, such as, for example, N-bromosuccinimide, N-chlorosuccinimide, furthermore chlorosulphonic acid, and also hypochlorites, such as, for example tert-butyl hypochlorite.

When carrying out the process (A) according to the invention, the reaction temperatures can be varied within a relatively wide range. In general, the reaction is carried out at temperatures between -40°C and 150°C, preferably between 0°C and 100°C.

10 The process (A) according to the invention is generally carried out under atmospheric pressure.

When carrying out the process (A) according to the invention, the reaction components of the formula (II) and the halogenating agents are generally employed in approximately equimolar amounts. However, it is also possible to use a relatively large excess (up to 3 mol) of one component or the other.

15 Process (B) is characterized in that compounds of the formula (II) in which A, D, W, X, Y and Z are as defined above are reacted in the presence of a diluent and in the presence of a nitrating agent.

Suitable diluents for the process (B) according to the invention are all inert organic solvents. Preference is given to using halogenated hydrocarbons, such as methylene chloride, chloroform, dichlorobenzene, dichloroethane.

20 Suitable nitrating agents are "nitrating acids", preferably fuming nitric acid.

When carrying out the process (B) according to the invention, the reaction temperatures can be varied within a relatively wide range. In general, the reaction is carried out at temperatures between -50°C and 150°C, preferably between 0°C and 80°C.

25 The process (B) according to the invention is generally carried out under atmospheric pressure.

When carrying out the process (B) according to the invention, the reaction components of the formula (II) and the nitrating agent are generally employed in approximately equimolar amounts. However, it is also possible to use a relatively large excess (up to 5 mol) of one component or the other.

The active compounds are well tolerated by plants, have favourable homeotherm toxicity and are environmentally friendly; they are suitable for protecting plants and plant organs, for increasing harvest yields, for improving the quality of the harvested material and for controlling animal pests, in particular insects, arachnids and nematodes encountered in agriculture, in forests, in gardens and leisure facilities, in the protection of stored products and materials and in the hygiene sector. They are preferably used as crop protection agents. They are active against normally sensitive and resistant species and against all or some stages of development. The abovementioned pests include:

5 From the order of the Isopoda, for example, *Oniscus asellus*, *Armadillidium vulgare* and *Porcellio scaber*.

10 From the order of the Diplopoda, for example, *Blaniulus guttulatus*.

From the order of the Chilopoda, for example, *Geophilus carpophagus* and *Scutigera spp.*

From the order of the Symphyla, for example, *Scutigerella immaculata*.

From the order of the Thysanura, for example, *Lepisma saccharina*.

15 From the order of the Collembola, for example, *Onychiurus armatus*.

From the order of the Orthoptera, for example, *Acheta domesticus*, *Gryllotalpa spp.*, *Locusta migratoria migratorioides*, *Melanoplus spp.* and *Schistocerca gregaria*.

From the order of the Blattaria, for example, *Blatta orientalis*, *Periplaneta americana*, *Leucophaea maderae* and *Blattella germanica*.

20 From the order of the Dermaptera, for example, *Forficula auricularia*.

From the order of the Isoptera, for example, *Reticulitermes spp.*

From the order of the Phthiraptera, for example, *Pediculus humanus corporis*, *Haematopinus spp.*, *Linognathus spp.*, *Trichodectes spp.*, *Damalinia spp.*

25 From the order of the Thysanoptera, for example, *Hercinothrips femoralis*, *Thrips tabaci*, *Thrips palmi*, *Frankliniella occidentalis*.

From the order of the Heteroptera, for example, *Eurygaster spp.*, *Dysdercus intermedius*, *Piesma quadrata*, *Cimex lectularius*, *Rhodnius prolixus* and *Triatoma spp.*

From the order of the Homoptera, for example, *Aleurodes brassicae*, *Bemisia tabaci*, *Trialeurodes vaporariorum*, *Aphis gossypii*, *Brevicoryne brassicae*, *Cryptomyzus ribis*, *Aphis fabae*, *Aphis pomi*,

Eriosoma lanigerum, Hyalopterus arundinis, Phylloxera vastatrix, Pemphigus spp., Macrosiphum avenae, Myzus spp., Phorodon humuli, Rhopalosiphum padi, Empoasca spp., Euscelis bilobatus, Nephrotettix cincticeps, Lecanium corni, Saissetia oleae, Laodelphax striatellus, Nilaparvata lugens, Aonidiella aurantii, Aspidiotus hederae, Pseudococcus spp. and Psylla spp.

- 5 From the order of the Lepidoptera, for example, *Pectinophora gossypiella, Bupalus piniarius, Cheimatobia brumata, Lithocolletis blancardella, Hyponomeuta padella, Plutella xylostella, Malacosoma neustria, Euproctis chrysorrhoea, Lymantria spp., Bucculatrix thurberiella, Phylloconistis citrella, Agrotis spp., Euxoa spp., Feltia spp., Earias insulana, Heliothis spp., Mamestra brassicae, Panolis flammea, Spodoptera spp., Trichoplusia ni, Carpocapsa pomonella, Pieris spp., Chilo spp., Pyrausta nubilalis, Ephestia kuehniella, Galleria mellonella, Tineola bisselliella, Tinea pellionella, Hofmannophila pseudospretella, Cacoecia podana, Capua reticulana, Choristoneura fumiferana, Clysia ambiguella, Homona magnanima, Tortrix viridana, Cnaphalocerus spp. and Oulema oryzae.*
- 10

From the order of the Coleoptera, for example, *Anobium punctatum, Rhizopertha dominica, Bruchidius obtectus, Acanthoscelides obtectus, Hylotrupes bajulus, Agelastica alni, Leptinotarsa decemlineata, Phaedon cochleariae, Diabrotica spp., Psylliodes chrysocephala, Epilachna varivestis, Atomaria spp., Oryzaephilus surinamensis, Anthonomus spp., Sitophilus spp., Otiorrhynchus sulcatus, Cosmopolites sordidus, Ceuthorrhynchus assimilis, Hypera postica, Dermestes spp., Trogoderma spp., Anthrenus spp., Attagenus spp., Lyctus spp., Meligethes aeneus, Ptinus spp., Niptus hololeucus, Gibbium psylloides, Tribolium spp., Tenebrio molitor, Agriotes spp., Conoderus spp., Melolontha melolontha, Amphimallon solstitialis, Costelytra zealandica and Lissorhoptrus oryzophilus.*

From the order of the Hymenoptera, for example, *Diprion spp., Hoplocampa spp., Lasius spp., Monomorium pharaonis and Vespa spp.*

From the order of the Diptera, for example, *Aedes spp., Anopheles spp., Culex spp., Drosophila melanogaster, Musca spp., Fannia spp., Calliphora erythrocephala, Lucilia spp., Chrysomyia spp., Cuterebra spp., Gastrophilus spp., Hypoboscidae spp., Stomoxyx spp., Oestrus spp., Hypoderma spp., Tabanus spp., Tannia spp., Bibio hortulanus, Oscinella frit, Phorbia spp., Pegomyia hyoscyami, Ceratitis capitata, Dacus oleae, Tipula paludosa, Hylemyia spp. and Liriomyza spp.*

From the order of the Siphonaptera, for example, *Xenopsylla cheopis and Ceratophyllus spp.*

30 From the order of the Arachnida, for example, *Scorpio maurus, Latrodectus mactans, Acarus siro, Argas spp., Ornithodoros spp., Dermacentor gallinae, Eriophyes ribis, Phyllocoptes oleivora, Boophilus spp., Rhipicephalus spp., Amblyomma spp., Hyalomma spp., Ixodes spp., Psoroptes spp., Chorioptes spp., Sarcoptes spp., Tarsonemus spp., Bryobia praetiosa, Panonychus spp., Tetranychus spp., Hemitarsonemus spp. and Brevipalpus spp.*

The plant-parasitic nematodes include, for example, *Pratylenchus* spp., *Radopholus similis*, *Ditylenchus dipsaci*, *Tylenchulus semipenetrans*, *Heterodera* spp., *Globodera* spp., *Meloidogyne* spp., *Aphelenchoides* spp., *Longidorus* spp., *Xiphinema* spp., *Trichodorus* spp. and *Bursaphelenchus* spp..

5 If appropriate, the compounds according to the invention may also be used in certain concentrations or application rates to act as herbicides and microbicides, for example as fungicides, antimycotics and bactericides. If appropriate, they can also be employed as intermediates or precursors for the synthesis of further active compounds.

10 All plants and plant parts can be treated in accordance with the invention. Plants are to be understood as meaning in the present context all plants and plant populations such as desired and undesired wild plants or crop plants (including naturally occurring crop plants). Crop plants can be plants which can be obtained by conventional plant breeding and optimization methods or by biotechnological and recombinant methods or by combinations of these methods, including the transgenic plants and inclusive of the plant cultivars protectable or not protectable by plant
15 breeders' rights. Plant parts are to be understood as meaning all parts and organs of plants above and below the ground, such as shoot, leaf, flower and root, examples which may be mentioned being leaves, needles, stalks, stems, flowers, fruit bodies, fruits, seeds, roots, tubers and rhizomes. The plant parts also include harvested material, and vegetative and generative propagation material, for example cuttings, tubers, rhizomes, offsets and seeds.

20 The treatment according to the invention of the plants and plant parts with the active compounds is carried out directly or by allowing the compounds to act on the surroundings, environment or storage space by the customary treatment methods, for example by immersion, spraying, evaporation, fogging, scattering, spreading or injecting and, in the case of propagation material, in particular in the case of seeds, also by applying one or more coats.

25 The active compounds can be converted into the customary formulations such as solutions, emulsions, wettable powders, suspensions, powders, dusts, pastes, soluble powders, granules, suspension-emulsion concentrates, natural and synthetic materials impregnated with active compound, and microencapsulations in polymeric materials.

30 These formulations are produced in a known manner, for example by mixing the active compounds with extenders, that is, liquid solvents and/or solid carriers, optionally with the use of surfactants, that is, emulsifiers and/or dispersants, and/or foam formers.

If the extender used is water, it is also possible, for example, to use organic solvents as cosolvents. The following are essentially suitable as liquid solvents: aromatics such as xylene, toluene or alkynaphthalenes, chlorinated aromatics or chlorinated aliphatic hydrocarbons such as

chlorobenzenes, chloroethylenes or methylene chloride, aliphatic hydrocarbons such as cyclohexane or paraffins, for example mineral oil fractions, mineral and vegetable oils, alcohols such as butanol or glycol and their ethers and esters, ketones such as acetone, methyl ethyl ketone, methyl isobutyl ketone or cyclohexanone, strongly polar solvents such as dimethylformamide and 5 dimethyl sulphoxide, or else water.

Suitable solid carriers are:

for example ammonium salts and ground natural minerals such as kaolins, clays, talc, chalk, quartz, attapulgite, montmorillonite or diatomaceous earth, and ground synthetic materials such as highly-disperse silica, alumina and silicates; suitable solid carriers for granules are: for example 10 crushed and fractionated natural rocks such as calcite, marble, pumice, sepiolite and dolomite, or else synthetic granules of inorganic and organic meals, and granules of organic material such as sawdust, coconut shells, maize cobs and tobacco stalks; suitable emulsifiers and/or foam formers are: for example nonionic and anionic emulsifiers such as polyoxyethylene fatty acid esters, polyoxyethylene fatty alcohol ethers, for example alkylaryl polyglycol ethers, alkylsulphonates, 15 alkyl sulphates, arylsulphonates, or else protein hydrolysates; suitable dispersants are: for example lignosulphite waste liquors and methylcellulose.

Tackifiers such as carboxymethylcellulose and natural and synthetic polymers in the form of powders, granules or latices, such as gum arabic, polyvinyl alcohol and polyvinyl acetate, or else natural phospholipids such as cephalins and lecithins and synthetic phospholipids can be used in 20 the formulations. Other additives can be mineral and vegetable oils.

It is possible to use colorants such as inorganic pigments, for example iron oxide, titanium oxide and Prussian Blue, and organic colorants such as alizarin colorants, azo colorants and metal phthalocyanine colorants, and trace nutrients such as salts of iron, manganese, boron, copper, cobalt, molybdenum and zinc.

25 The formulations generally comprise between 0.1 and 95% by weight of active compound, preferably between 0.5 and 90%.

The active compounds according to the invention, as such or in their formulations, can also be used as a mixture with known fungicides, bactericides, acaricides, nematicides or insecticides, for example in order to widen the spectrum of action or to prevent the development of resistances in 30 this way. In many cases, synergistic effects result, i.e. the activity of the mixture exceeds the activity of the individual components.

Compounds which are suitable as components in the mixtures are, for example, the following:

Fungicides:

2-phenylphenol; 8-hydroxyquinoline sulphate; acibenzolar-S-methyl; aldimorph; amidoflumet; ampropylfos; ampropylfos-potassium; andoprim; anilazine; azaconazole; azoxystrobin; benalaxyl; benodanil; benomyl; benthiavalicarb-isopropyl; benzamacril; benzamacril-isobutyl; bilanafos; binapacryl; biphenyl; bitertanol; blasticidin-S; bromuconazole; bupirimate; buthiobate; 5 butylamine; calcium polysulphide; capsimycin; captafol; captan; carbendazim; carboxin; carpropamid; carvone; chinomethionat; chlobenthiazole; chlorfenazole; chloroneb; chlorothalonil; chlozolinate; clozylacon; cyazofamid; cyflufenamid; cymoxanil; cyproconazole; cyprodinil; cyprofuram; Dagger G; debacarb; dichlofluanid; dichlone; dichlorophen; diclocymet; diclomezine; dicloran; diethofencarb; difenoconazole; diflumetorim; dimethirimol; dimethomorph; 10 dimoxystrobin; diniconazole; diniconazole-M; dinocap; diphenylamine; dipyrithione; ditalimfos; dithianon; dodine; drazoxolon; edifenphos; epoxiconazole; ethaboxam; ethirimol; etridiazole; famoxadone; fenamidone; fenapanil; fenarimol; fenbuconazole; fenfuram; fenhexamid; fenitropan; fenoxyanil; fenpiclonil; fenpropidin; fenpropimorph; ferbam; fluazinam; flubenzimine; fludioxonil; flumetover; flumorph; fluoromide; fluoxastrobin; fluquinconazole; flurprimidol; flusilazole; 15 flusulfamide; flutolanil; flutriafol; folpet; fosetyl-Al; fosetyl-sodium; fuberidazole; furalaxyl; furametpyr; furcarbanil; furmecyclox; guazatine; hexachlorobenzene; hexaconazole; hymexazole; imazalil; imibenconazole; iminoctadine triacetate; iminoctadine tris(albesil); iodocarb; ipconazole; iprobenfos; iprodione; iprovalicarb; irumamycin; isoprothiolane; isovaliedione; kasugamycin; kresoxim-methyl; mancozeb; maneb; meferimzone; mepanipyrim; mepronil; metalaxyl; metalaxyl- 20 M; metconazole; methasulfocarb; methfuroxam; metiram; metominostrobin; metsulfovax; mildiomycin; myclobutanil; myclozolin; natamycin; nicobifen; nitrothal-isopropyl; noviflumuron; nuarimol; ofurace; orysastrobin; oxadixyl; oxolinic acid; oxpoconazole; oxycarboxin; oxyfenthiin; paclobutrazole; pefurazole; penconazole; pencycuron; phosdiphen; phthalide; picoxystrobin; piperalin; polyoxins; polyoxorim; probenazole; prochloraz; procymidone; propamocarb; 25 propanosine-sodium; propiconazole; propineb; proquinazid; prothioconazole; pyraclostrobin; pyrazophos; pyrifenoxy; pyrimethanil; pyroquilon; pyroxyfur; pyrrolenitrine; quinconazole; quinoxifen; quintozene; simeconazole; spiroxamine; sulphur; tebuconazole; tecloftalam; tecnazene; tetcyclacis; tetraconazole; thiabendazole; thicyofen; thifluzamide; thiophanate-methyl; thiram; tioxymid; tolclofos-methyl; tolylfluanid; triadimefon; triadimenol; triazbutil; triazoxide; 30 tricyclamide; tricyclazole; tridemorph; trifloxystrobin; triflumizole; triforine; triticonazole; uniconazole; validamycin A; vinclozolin; zineb; ziram; zoxamide; (2S)-N-[2-[4-[(3-(4-chlorophenyl)-2-propynyl]oxy]-3-methoxyphenyl]ethyl]-3-methyl-2-[(methylsulphonyl)amino]-butanamide; 1-(1-naphthalenyl)-1H-pyrrole-2,5-dione; 2,3,5,6-tetrachloro-4-(methylsulphonyl)-pyridine; 2-amino-4-methyl-N-phenyl-5-thiazolecarboxamide; 2-chloro-N-(2,3-dihydro-1,1,3- 35 trimethyl-1H-inden-4-yl)-3-pyridinecarboxamide; 3,4,5-trichloro-2,6-pyridinedicarbonitrile; actinovate; cis-1-(4-chlorophenyl)-2-(1H-1,2,4-triazol-1-yl)cycloheptanol; methyl 1-(2,3-dihydro-2,2-dimethyl-1H-inden-1-yl)-1H-imidazole-5-carboxylate; monopotassium carbonate; N-(6-methoxy-3-pyridinyl)cyclopropanecarboxamide; N-butyl-8-(1,1-dimethylethyl)-1-oxaspiro-

[4.5]decane-3-amine; sodium tetrathiocarbonate;

and copper salts and preparations, such as Bordeaux mixture; copper hydroxide; copper naphthenate; copper oxychloride; copper sulphate; cufraneb; cuprous oxide; mancopper; oxine-copper.

5 **Bactericides:**

bronopol, dichlorophen, nitrapyrin, nickel dimethyldithiocarbamate, kasugamycin, othilinone, furancarboxylic acid, oxytetracyclin, probenazole, streptomycin, tecloftalam, copper sulphate and other copper preparations.

Insecticides/acaricides/nematicides:

10 abamectin, ABG-9008, acephate, acequimocyl, acetamiprid, acetoprole, acrinathrin, AKD-1022, AKD-3059, AKD-3088, alanycarb, aldicarb, aldoxycarb, allethrin, alpha-cypermethrin (alphamethrin), amidoflumet, aminocarb, amitraz, avermectin, AZ-60541, azadirachtin, azamethiphos, azinphos-methyl, azinphos-ethyl, azocyclotin,

15 Bacillus popilliae, Bacillus sphaericus, Bacillus subtilis, Bacillus thuringiensis, Bacillus thuringiensis strain EG-2348, Bacillus thuringiensis strain GC-91, Bacillus thuringiensis strain NCTC-11821, baculoviruses, Beauveria bassiana, Beauveria tenella, benclothiaz, bendiocarb, benfuracarb, bensultap, benzoximate, beta-cyfluthrin, beta-cypermethrin, bifenazate, bifenthrin, binapacryl, bioallethrin, bioallethrin-S-cyclopentyl-isomer, bioethanomethrin, biopermethrin, bioresmethrin, bistrifluron, BPMC, brofenprox, bromophos-ethyl, bromopropylate, bromfenvinfos (-methyl), BTG-504, BTG-505, bufencarb, buprofezin, butathiofos, butocarboxim, butoxycarboxim, butylpyridaben,

25 cadusafos, camphechlor, carbaryl, carbofuran, carbophenothion, carbosulfan, cartap, CGA-50439, chinomethionat, chlordane, chlordimeform, chloethocarb, chlorethoxyfos, chlorfenapyr, chlorfenvinphos, chlorfluazuron, chlormephos, chlorobenzilate, chloropicrin, chlorproxyfen, chlorpyrifos-methyl, chlorpyrifos (-ethyl), chlovaporthrin, chromafenozide, cis-cypermethrin, cis-resmethrin, cis-permethrin, clocythrin, cloethocarb, clofentezine, clothianidin, clothiazaben, codlemone, coumaphos, cyanofenphos, cyanophos, cyclopren, cycloprothrin, Cydia pomonella, cyfluthrin, cyhalothrin, cyhexatin, cypermethrin, cyphenothrin (1R-trans-isomer), cyromazine,

30 DDT, deltamethrin, demeton-S-methyl, demeton-S-methylsulphone, diafenthuron, dialifos, diazinon, dichlofenthion, dichlorvos, dicofol, dicrotophos, dicyclanil, diflubenzuron, dimefluthrin, dimethoate, dimethylvinphos, dinobuton, dinocap, dinotefuran, diofenolan, disulfoton, docusat-sodium, dofenapyn, DOWCO-439,

eflusilanate, emamectin, emamectin-benzoate, empenthrin (1R-isomer), endosulfan, Entomophthora spp., EPN, esfenvalerate, ethiofencarb, ethiprole, ethion, ethoprophos, etofenprox, etoxazole, etrimfos,

5 famphur, fenamiphos, fenazaquin, fenbutatin oxide, fenfluthrin, fenitrothion, fenobucarb, fenothiocarb, fenoxacrim, fenoxy carb, fenpropothrin, fenpyrad, fenpyrithrin, fenpyroximate, fensulfothion, fenthion, fentrifanil, fenvalerate, fipronil, flonicamid, fluacrypyrim, fluazuron, flubenzimine, flubrocythrinate, flucycloxuron, flucythrinate, flufenerim, flufenoxuron, flufenprox, flumethrin, flupyrazofos, flutenzin (flufenzine), fluvalinate, fonofos, formetanate, formothion, fosmethilan, fosthiazate, fubfenprox (fluproxyfen), furathiocarb,

10 gamma-cyralothrin, gamma-HCH, gossyplure, grandlure, granulosis viruses, halfenprox, halofenozone, HCH, HCN-801, heptenophos, hexaflumuron, hexythiazox, hydramethylnone, hydroprene,
IKA-2002, imidaclorpid, imiprothrin, indoxacarb, iodofenphos, iprobenfos, isazofos, isofenphos, isoprocarb, isoxathion, ivermectin,

15 japonilure,
kadethrin, nuclear polyhedrosis viruses, kinoprene,
lambda-cyhalothrin, lindane, lufenuron,
malathion, mecarbam, mesulfenfos, metaldehyde, metam-sodium, methacrifos, methamidophos, Metharhizium anisopliae, Metharhizium flavoviride, methidathion, methiocarb, methomyl, methoprene, methoxychlor, methoxyfenozide, metofluthrin, metolcarb, metoxadiazone, mevinphos, milbemectin, milbemycin, MKI-245, MON-45700, monocrotophos, moxidectin, MTI-800,
naled, NC-104, NC-170, NC-184, NC-194, NC-196, niclosamide, nicotine, nitenpyram, nithiazine, NNI-0001, NNI-0101, NNI-0250, NNI-9768, novaluron, noviflumuron,

25 OK-5101, OK-5201, OK-9601, OK-9602, OK-9701, OK-9802, omethoate, oxamyl, oxydemeton-methyl,
Paecilomyces fumosoroseus, parathion-methyl, parathion (-ethyl), permethrin (cis-, trans-), petroleum, PH-6045, phenothrin (1R-trans isomer), phentoate, phorate, phosalone, phosmet, phosphamidon, phosphocarb, phoxim, piperonyl butoxide, pirimicarb, pirimiphos-methyl, 30 pirimiphos-ethyl, potassium oleate, prallethrin, profenofos, prefluthrin, promecarb, propaphos, propargite, propetamphos, propoxur, prothiofos, prothoate, protrifenbute, pymetrozine, pyraclofos,

pyresmethrin, pyrethrum, pyridaben, pyridalyl, pyridaphenthion, pyridathion, pyrimidifen,
pyriproxyfen,

quinalphos,

resmethrin, RH-5849, ribavirin, RU-12457, RU-15525,

5 S-421, S-1833, salithion, sebufos, SI-0009, silafluofen, spinosad, spirodiclofen, spiromesifen,
sulfuramid, sulfotep, sulprofos, SZI-121,

tau-fluvalinate, tebufenozide, tebufenpyrad, tebupirimfos, teflubenzuron, tefluthrin, temephos,
temivinphos, terbam, terbufos, tetrachlorvinphos, tetradifon, tetramethrin, tetramethrin (1R-
isomer), tetrasul, theta-cypermethrin, thiacloprid, thiamethoxam, thiapronil, thiatriphos,
10 thiocyclam hydrogen oxalate, thiodicarb, thiofanox, thiometon, thiosultap-sodium, thuringiensin,
tolfenpyrad, tralocythrin, tralomethrin, transfluthrin, triarathene, triazamate, triazophos, triazuron,
trichlophenidine, trichlorfon, Trichoderma atroviride, triflumuron, trimethacarb,

vamidothion, vaniliprole, verbutin, Verticillium lecanii,

WL-108477, WL-40027,

15 YI-5201, YI-5301, YI-5302,

XMC, xylylcarb,

ZA-3274, zeta-cypermethrin, zolaprofos, ZXI-8901,

the compound 3-methylphenyl propylcarbamate (tsumacide Z),

the compound 3-(5-chloro-3-pyridinyl)-8-(2,2,2-trifluoroethyl)-8-azabicyclo[3.2.1]octane-3-carbo-

20 nitrile (CAS-Reg. No. 185982-80-3) and the corresponding 3-endo-isomer (CAS-Reg. No. 185984-
60-5) (cf. WO-96/37494, WO-98/25923),

and preparations which comprise insecticidally active plant extracts, nematodes, fungi or viruses.

A mixture with other known active compounds, such as herbicides, or with fertilizers and growth
regulators, safeners and/or semiochemicals is also possible.

25 When used as insecticides in their commercially available formulations and in the use forms prepared
with these formulations, the active compounds according to the invention can furthermore be present
in the form of a mixture with synergists. Synergists are compounds by which the activity of the active
compounds is increased without it being necessary for the synergist added to be active itself.

When used as insecticides in their commercially available formulations and in the use forms prepared with these formulations, the active compounds according to the invention can furthermore be present in the form of a mixture with inhibitors which reduce the degradation of the active compound after application in the habitat of the plant, on the surface of parts of plants or in plant tissues.

The active compound content of the use forms prepared from the commercially available formulations can vary within broad ranges. The active compound concentration of the use forms can be from 0.0000001 up to 95% by weight of active compound, preferably between 0.0001 and 1% by weight.

10 They are applied in a customary manner adapted to suit the use forms.

When used against hygiene pests and pests of stored products, the active compound is distinguished by excellent residual action on wood and clay as well as good stability to alkali on limed substrates.

15 As already mentioned above, it is possible to treat all plants or their parts in accordance with the invention. In a preferred embodiment, wild plant species or plant varieties and plant cultivars which have been obtained by traditional biological breeding methods, such as hybridization or protoplast fusion, and the parts of these varieties and cultivars are treated. In a further preferred embodiment, transgenic plants and plant cultivars which have been obtained by recombinant methods, if appropriate in combination with conventional methods (genetic modified organisms), and their parts 20 are treated. The term "parts" or "parts of plants" or "plant parts" has been explained above.

Plants which are treated particularly preferably in accordance with the invention are those of the plant cultivars which are in each case commercially available or in use. Plant cultivars are understood as meaning plants with new traits which have been bred either by conventional breeding, by mutagenesis or by recombinant DNA techniques. They may take the form of cultivars, biotypes and 25 genotypes.

Depending on the plant species or plant cultivars, their location and growth conditions (soils, climate, vegetation period, nutrition), the treatment according to the invention may also result in superadditive ("synergistic") effects. Thus, for example, reduced application rates and/or a widened activity spectrum and/or an increase in the activity of the substances and compositions which can be used in 30 accordance with the invention, better plant growth, increased tolerance to high or low temperatures, increased tolerance to drought or to salinity in the water or soil, increased flowering performance, facilitated harvesting, accelerated maturation, higher yields, higher quality and/or better nutritional value of the harvested products, better storage characteristics and/or processability of the harvested products are possible which exceed the effects which were actually to be expected.

The preferred transgenic plants or plant cultivars (those obtained by recombinant methods) to be treated in accordance with the invention include all those plants which, owing to the process of recombinant modification, were given genetic material which confers particular, advantageous, valuable traits to these plants. Examples of such properties are better plant growth, increased tolerance to high or low temperatures, increased tolerance to drought or to salinity in the water or soil, increased flowering performance, facilitated harvesting, accelerated maturation, higher yields, higher quality and/or higher nutritional value of the harvested products, better storage characteristics and/or better processability of the harvested products. Further examples of such traits, examples which must be mentioned especially, are better defence of the plants against animal and microbial pests, such as against insects, mites, phytopathogenic fungi, bacteria and/or viruses and an increased tolerance of the plants to certain herbicidal active compounds. Examples of transgenic plants which may be mentioned are the important crop plants, such as cereals (wheat, rice), maize, soybeans, potato, cotton, tobacco, oilseed rape and fruit plants (with the fruits apples, pears, citrus fruits and grapes), with particular emphasis on maize, soybeans, potatoes, cotton tobacco, and oilseed rape.

Traits which are especially emphasized are the increased defence of the plants against insects, arachnids, nematodes, and slugs and snails owing to toxins being formed in the plants, in particular toxins which are generated in the plants by the genetic material of *Bacillus thuringiensis* (for example by the genes CryIA(a), CryIA(b), CryIA(c), CryIIA, CryIIIA, CryIIB2, Cry9c Cry2Ab, Cry3Bb and CryIF and their combinations; hereinbelow "Bt plants"). Other traits which are particularly emphasized are the increased defence of plants against fungi, bacteria and viruses by the systemic acquired resistance (SAR), systemin, phytoalexins, elicitors and resistance genes and correspondingly expressed proteins and toxins. Other traits which are especially emphasized are the increased tolerance of the plants to certain herbicidal active compounds, for example imidazolinones, sulphonylureas, glyphosate or phosphinotricin (for example "PAT" gene). The genes which confer the desired traits in each case may also be present in the transgenic plants in combination with one another. Examples of "Bt plants" which may be mentioned are maize cultivars, cotton cultivars, soybean cultivars and potato cultivars which are commercially available under the trade names YIELD GARD® (for example maize, cotton, soybeans), KnockOut® (for example maize), StarLink® (for example maize), Bollgard® (cotton), Nucotn® (cotton) and NewLeaf® (potato).

Examples of herbicide-tolerant plants which may be mentioned are maize cultivars, cotton cultivars and soybean cultivars which are commercially available under the trade names Roundup Ready® (tolerance to glyphosate, for example maize, cotton, soybean), Liberty Link® (tolerance to phosphinotricin, for example oilseed rape), IMI® (tolerance to imidazolinones) and STS® (tolerance to sulphonylureas, for example maize). Herbicide-resistant plants (plants bred in a conventional manner for herbicide tolerance) which may be mentioned include also the varieties commercially available under the name Clearfield® (for example maize). Naturally, these statements also apply to plant cultivars having these genetic traits or genetic traits still to be developed, which plant cultivars will be developed and/or marketed in the future.

The plants listed can be treated particularly advantageously according to the invention with the compounds of the general formula I or the active compound mixtures according to the invention. The preferred ranges stated above for the active compounds and mixtures also apply to the treatment of these plants. Particular emphasis may be given to the treatment of plants with the compounds or mixtures specifically mentioned in the present text.

The active compounds according to the invention are not only active against plant, hygiene and stored-product pests, but also, in the veterinary medicine sector, against animal parasites (ectoparasites), such as ixodid ticks, argasid ticks, scab mites, trombi-culid mites, flies (stinging and sucking), parasitic fly larvae, lice, hair lice, bird lice and fleas. These parasites include:

10 From the order of the Anoplurida, for example, *Haematopinus* spp., *Linognathus* spp., *Pediculus* spp., *Phtirus* spp., *Solenopotes* spp..

From the order of the Mallophagida and the sub-orders Amblycerina and Ischnocerina, for example, *Trimenopon* spp., *Menopon* spp., *Trinoton* spp., *Bovicola* spp., *Werneckiella* spp., *Lepikentron* spp., *Damalina* spp., *Trichodectes* spp., *Felicola* spp..

15 From the order of the Diptera and the sub-orders Nematocerina and Brachycerina, for example, *Aedes* spp., *Anopheles* spp., *Culex* spp., *Simulium* spp., *Eusimulium* spp., *Phlebotomus* spp., *Lutzomyia* spp., *Culicoides* spp., *Chrysops* spp., *Hybomitra* spp., *Atylotus* spp., *Tabanus* spp., *Haematopota* spp., *Philipomyia* spp., *Braula* spp., *Musca* spp., *Hydrotaea* spp., *Stomoxys* spp., *Haematobia* spp., *Morellia* spp., *Fannia* spp., *Glossina* spp., *Calliphora* spp., *Lucilia* spp.,
20 *Chrysomyia* spp., *Wohlfahrtia* spp., *Sarcophaga* spp., *Oestrus* spp., *Hypoderma* spp., *Gasterophilus* spp., *Hippobosca* spp., *Lipoptena* spp. and *Melophagus* spp..

From the order of the Siphonapterida, for example, *Pulex* spp., *Ctenocephalides* spp., *Xenopsylla* spp. and *Ceratophyllus* spp..

25 From the order of the Heteroptera, for example, *Cimex* spp., *Triatoma* spp., *Rhodnius* spp. and *Panstrongylus* spp..

From the order of the Blattarida, for example, *Blatta orientalis*, *Periplaneta americana*, *Blattella germanica* and *Supella* spp..

30 From the sub-class of the Acaria (Acarida) and the orders of the Meta- and Mesostigmata, for example, *Argas* spp., *Ornithodoros* spp., *Otobius* spp., *Ixodes* spp., *Amblyomma* spp., *Boophilus* spp., *Dermacentor* spp., *Haemophysalis* spp., *Hyalomma* spp., *Rhipicephalus* spp., *Dermanyssus* spp., *Raillietia* spp., *Pneumonyssus* spp., *Sternostoma* spp. and *Varroa* spp..

From the order of the Actinedida (Prostigmata) and Acarida (Astigmata), for example, *Acarapis* spp., *Cheyletiella* spp., *Ornithocheyletia* spp., *Myobia* spp., *Psorergates* spp., *Demodex* spp., *Trombicula* spp., *Listrophorus* spp., *Acarus* spp., *Tyrophagus* spp., *Caloglyphus* spp., *Hypodectes* spp., *Pterolichus* spp., *Psoroptes* spp., *Chorioptes* spp., *Otodectes* spp., *Sarcoptes* spp., *Notoedres* spp., *Knemidocoptes* spp., *Cytodites* spp. and *Laminozioptes* spp..

The active compounds of the formula (I) according to the invention are also suitable for controlling arthropods which attack agricultural livestock, such as, for example, cattle, sheep, goats, horses, pigs, donkeys, camels, buffaloes, rabbits, chickens, turkeys, ducks, geese, honeybees, other domestic animals, such as, for example, dogs, cats, cage birds, aquarium fish, and so-called experimental animals, such as, for example, hamsters, guinea-pigs, rats and mice. By combating these arthropods, it is intended to reduce deaths and decreased performances (in meat, milk, wool, hides, eggs, honey and the like), so that more economical and simpler animal keeping is made possible by using the active compounds according to the invention.

In the veterinary sector, the active compounds according to the invention are used in a known manner by enteral administration, for example in the form of tablets, capsules, drinks, drenches, granules, pastes, boli, the feed-through method, suppositories, by parenteral administration, such as, for example, by means of injections (intramuscular, subcutaneous, intravenous, intraperitoneal and the like), implants, by nasal application, by dermal administration, for example in the form of dipping or bathing, spraying, pouring-on and spotting-on, washing, dusting, and with the aid of shaped articles which comprise active compound, such as collars, ear tags, tail marks, limb bands, halters, marking devices and the like.

When administered to livestock, poultry, domestic animals and the like, the active compounds of the formula (I) can be used as formulations (for example powders, emulsions, flowables) which comprise the active compounds in an amount of 1 to 80% by weight, either directly or after dilution by a factor of 100 to 10 000, or they may be used in the form of a chemical bath.

Furthermore, it has been found that the compounds according to the invention have a potent insecticidal action against insects which destroy industrial materials.

The following insects may be mentioned by way of example and as being preferred, but without any limitation:

Beetles, such as

Hylotrupes bajulus, *Chlorophorus pilosis*, *Anobium punctatum*, *Xestobium rufovillosum*, *Ptilinus pecticornis*, *Dendrobium pertinex*, *Ernobius mollis*, *Priobium carpini*, *Lyctus brunneus*, *Lyctus africanus*, *Lyctus planicollis*, *Lyctus linearis*, *Lyctus pubescens*, *Trogoxylon aequale*, *Minthes*

rugicollis, Xyleborus spec., Tryptodendron spec., Apate monachus, Bostrychus capucins, Heterobostrychus brunneus, Sinoxylon spec., Dinoderus minutus.

Dermapterans, such as

Sirex juvencus, Urocerus gigas, Urocerus gigas tagnus, Urocerus augur.

5 Termites, such as

Kalotermes flavicollis, Cryptotermes brevis, Heterotermes indicola, Reticulitermes flavipes, Reticulitermes santonensis, Reticulitermes lucifugus, Mastotermes darwiniensis, Zootermopsis nevadensis, Coptotermes formosanus.

Bristletails, such as Lepisma saccharina.

10 Industrial materials are to be understood as meaning, in the present context, non-live materials, such as, preferably, synthetic materials, glues, sizes, paper and board, leather, wood and timber products, and paint.

The materials to be very particularly preferably protected against attack by insects are wood and timber products.

15 Wood and timber products which can be protected by the composition according to the invention or mixtures comprising such a composition are to be understood as meaning, for example:

construction timber, wooden beams, railway sleepers, bridge components, jetties, wooden vehicles, boxes, pallets, containers, telephone poles, wood cladding, windows and doors made of wood, plywood, particle board, joiner's articles, or wood products which, quite generally, are used in the
20 construction of houses or in joinery.

The active compounds can be used as such, in the form of concentrates or generally customary formulations, such as powders, granules, solutions, suspensions, emulsions or pastes.

The formulations mentioned can be prepared in a manner known per se, for example by mixing the active compounds with at least one solvent or diluent, emulsifier, dispersant and/or binder or
25 fixative, water repellent, if appropriate desiccants and UV stabilizers and, if appropriate, colorants and pigments and other processing auxiliaries.

The insecticidal compositions or concentrates used for the protection of wood and wooden materials comprise the active compound according to the invention in a concentration of 0.0001 to 95% by weight, in particular 0.001 to 60% by weight.

The amount of the compositions or concentrates employed depends on the species and the occurrence of the insects and on the medium. The optimum rate of application can be determined upon use in each case by a test series. However, in general, it suffices to employ 0.0001 to 20% by weight, preferably 0.001 to 10% by weight, of the active compound, based on the material to be

5

protected.

The solvent and/or diluent used is an organochemical solvent or solvent mixture and/or an oily or oil-type organochemical solvent or solvent mixture of low volatility and/or a polar organochemical solvent or solvent mixture and/or water and, if appropriate, an emulsifier and/or wetting agent.

Organic solvents which are preferably employed are oily or oil-type solvents having an

10

evaporation number of above 35 and a flashpoint of above 30°C, preferably above 45°C. Substances which are used as such oily and oil-type solvents which have low volatility and are insoluble in water are suitable mineral oils or their aromatic fractions, or mineral-oil-containing solvent mixtures, preferably white spirit, petroleum and/or alkylbenzene.

Substances which are advantageously used are mineral oils with a boiling range of 170 to 220°C,

15

white spirit with a boiling range of 170 to 220°C, spindle oil with a boiling range of 250 to 350°C, petroleum or aromatics of boiling range 160 to 280°C, essence of terpine and the like.

In a preferred embodiment, liquid aliphatic hydrocarbons with a boiling range of 180 to 210°C or high-boiling mixtures of aromatic and aliphatic hydrocarbons with a boiling range of 180 to 220°C and/or spindle oil and/or monochloronaphthalene, preferably α -monochloronaphthalene, are used.

20

The organic oily or oil-type solvents of low volatility having an evaporation number of above 35 and a flashpoint of above 30°C, preferably above 45°C, can be partially replaced by organochemical solvents of high or medium volatility, with the proviso that the solvent mixture also has an evaporation number of above 35 and a flashpoint of above 30°C, preferably above 45°C, and that the insecticide/fungicide mixture is soluble or emulsifiable in this solvent mixture.

25

In a preferred embodiment, part of the organochemical solvent or solvent mixture is replaced or an aliphatic polar organochemical solvent or solvent mixture. Substances which are preferably used are aliphatic organochemical solvents having hydroxyl and/or ester and/or ether groups, such as, for example, glycol ethers, esters and the like.

The organochemical binders used within the scope of the present invention are the synthetic resins

30

and/or binding drying oils which are known per se and can be diluted with water and/or are soluble or dispersible or emulsifiable in the organochemical solvents employed, in particular binders composed of, or comprising, an acrylate resin, a vinyl resin, for example polyvinyl acetate, polyester resin, polycondensation or polyaddition resin, polyurethane resin, alkyd resin or

modified alkyd resin, phenol resin, hydrocarbon resin, such as indene/cumarone resin, silicone resin, drying vegetable and/or drying oils and/or physically drying binders based on a natural and/or synthetic resin.

The synthetic resin used as the binder can be employed in the form of an emulsion, dispersion or

5 solution. Up to 10% by weight of bitumen or bituminous substances can also be used as binders. In addition, colorants, pigments, water repellents, odour-masking substances and inhibitors or anticorrosives known per se and the like can also be employed.

The composition or the concentrate preferably comprises, in accordance with the invention, at least one alkyd resin or modified alkyd resin and/or a drying vegetable oil as the organochemical binder.

10 Preferably used according to the invention are alkyd resins with an oil content of over 45% by weight, preferably 50 to 68% by weight.

All or some of the above-mentioned binder can be replaced by a fixative (mixture) or a plasticizer (mixture). These additives are intended to prevent volatilization of the active compounds and crystallization or precipitation. They preferably replace 0.01 to 30% of the binder (based on 100% 15 of binder employed).

The plasticizers are from the chemical classes of the phthalic esters, such as dibutyl phthalate, dioctyl phthalate or benzyl butyl phthalate, the phosphoric esters, such as tributyl phosphate, the adipic esters, such as di-(2-ethylhexyl) adipate, the stearates, such as butyl stearate or amyl stearate, the oleates, such as butyl oleate, the glycerol ethers or relatively high-molecular-weight 20 glycol ethers, glycerol esters and p-toluenesulphonic esters.

Fixatives are chemically based on polyvinyl alkyl ethers, such as, for example, polyvinyl methyl ether, or ketones, such as benzophenone or ethylenebenzophenone.

Particularly suitable as a solvent or diluent is also water, if appropriate as a mixture with one or more of the above-mentioned organochemical solvents or diluents, emulsifiers and dispersants.

25 Particularly effective protection of wood is achieved by large-scale industrial impregnation processes, for example vacuum, double-vacuum or pressure processes.

If appropriate, the ready-to-use compositions can additionally comprise other insecticides and, if appropriate, additionally one or more fungicides.

Suitable additional components which may be admixed are, preferably, the insecticides and 30 fungicides mentioned in WO 94/29 268. The compounds mentioned in that document are expressly part of the present application.

Very particularly preferred components which may be admixed are insecticides, such as chlorpyriphos, phoxim, silafluofin, alphamethrin, cyfluthrin, cypermethrin, deltamethrin, permethrin, imidacloprid, NI-25, flufenoxuron, hexaflumuron, transfluthrin, thiacloprid, methoxyphenoxid, triflumuron, chlothianidin, spinosad, tefluthrin,

5 and fungicides, such as epoxyconazole, hexaconazole, azaconazole, propiconazole, tebuconazole, cyproconazole, metconazole, imazalil, dichlofluanid, tolylfluanid, 3-iodo-2-propynylbutyl carbamate, N-octyl-isothiazolin-3-one and 4,5-dichloro-N-octylisothiazolin-3-one.

The compounds according to the invention can at the same time be employed for protecting objects which come into contact with salt water or brackish water, in particular hulls, screens, nets, buildings, moorings and signalling systems, against fouling.

10 Fouling by sessile Oligochaeta, such as Serpulidae, and by shells and species from the Ledamorpha group (goose barnacles), such as various Lepas and Scalpellum species, or by species from the Balanomorpha group (acorn barnacles), such as Balanus or Pollicipes species, increases the frictional drag of ships and, as a consequence, leads to a marked increase in operation costs owing to higher energy consumption and additionally frequent residence in the dry dock.

Apart from fouling by algae, for example Ectocarpus sp. and Ceramium sp., fouling by sessile Entomostraka groups, which come under the generic term Cirripedia (cirriped crustaceans), is of particular importance.

20 Surprisingly, it has now been found that the compounds according to the invention, alone or in combination with other active compounds, have an outstanding antifouling action.

Using the compounds according to the invention, alone or in combination with other active compounds, allows the use of heavy metals such as, for example, in bis(trialkyltin) sulphides, tri-*n*-butyltin laurate, tri-*n*-butyltin chloride, copper(I) oxide, triethyltin chloride, tri-*n*-butyl-(2-phenyl-4-chlorophenoxy)tin, tributyltin oxide, molybdenum disulphide, antimony oxide, polymeric butyl titanate, phenyl-(bispyridine)-bismuth chloride, tri-*n*-butyltin fluoride, manganese ethylenebisthiocarbamate, zinc dimethyldithiocarbamate, zinc ethylenebisthiocarbamate, zinc salts and copper salts of 2-pyridinethiol 1-oxide, bisdimethyldithiocarbamoylzinc ethylene-bisthiocarbamate, zinc oxide, copper(I) ethylene-bisdithiocarbamate, copper thiocyanate, copper naphthenate and tri-butyltin halides to be dispensed with, or the concentration of these compounds to be substantially reduced.

If appropriate, the ready-to-use antifouling paints can additionally comprise other active compounds, preferably algicides, fungicides, herbicides, molluscicides, or other antifouling active compounds.

Preferably suitable components in combination with the antifouling compositions according to the invention are:

algicides such as

2-*tert*-butylamino-4-cyclopropylamino-6-methylthio-1,3,5-triazine, dichlorophen, diuron, endothal,
5 fentin acetate, isoproturon, methabenzthiazuron, oxyfluorfen, quinoclamine and terbutryn;

fungicides such as

benzo[*b*]thiophenecarboxylic acid cyclohexylamide S,S-dioxide, dichlofluanid, fluorfolpet, 3-iodo-
2-propinyl butylcarbamate, tolylfluanid and azoles such as

azaconazole, cyproconazole, epoxyconazole, hexaconazole, metconazole, propiconazole and
10 tebuconazole;

molluscicides such as

fentin acetate, metaldehyde, methiocarb, niclosamid, thiodicarb and trimethacarb; Fe chelates;

or conventional antifouling active compounds such as

4,5-dichloro-2-octyl-4-isothiazolin-3-one, diiodomethylparatryl sulphone, 2-(N,N-dimethyl-
15 thiocarbamoylthio)-5-nitrothiazyl, potassium, copper, sodium and zinc salts of 2-pyridinethiol
1-oxide, pyridine-triphenylborane, tetrabutyldistannoxane, 2,3,5,6-tetrachloro-
4-(methylsulphonyl)-pyridine, 2,4,5,6-tetrachloroisophthalonitrile, tetramethylthiuram disulphide
and 2,4,6-trichlorophenylmaleimide.

The antifouling compositions used comprise the active compound according to the invention of the
20 compounds according to the invention in a concentration of 0.001 to 50% by weight, in particular
0.01 to 20% by weight.

Moreover, the antifouling compositions according to the invention comprise the customary
components such as, for example, those described in Ungerer, *Chem. Ind.* 1985, 37, 730-732 and
Williams, *Antifouling Marine Coatings*, Noyes, Park Ridge, 1973.

25 Besides the algicidal, fungicidal, molluscicidal active compounds and insecticidal active
compounds according to the invention, antifouling paints comprise, in particular, binders.

Examples of recognized binders are polyvinyl chloride in a solvent system, chlorinated rubber in a
solvent system, acrylic resins in a solvent system, in particular in an aqueous system, vinyl
chloride/vinyl acetate copolymer systems in the form of aqueous dispersions or in the form of
30 organic solvent systems, butadiene/styrene/acrylonitrile rubbers, drying oils such as linseed oil,

resin esters or modified hardened resins in combination with tar or bitumens, asphalt and epoxy compounds, small amounts of chlorine rubber, chlorinated polypropylene and vinyl resins.

If appropriate, paints also comprise inorganic pigments, organic pigments or colorants which are preferably insoluble in salt water. Paints may furthermore comprise materials such as rosin to allow controlled release of the active compounds. Furthermore, the paints may comprise plasticizers, modifiers which affect the rheological properties and other conventional constituents. The compounds according to the invention or the above-mentioned mixtures may also be incorporated into self-polishing antifouling systems.

The active compounds are also suitable for controlling animal pests, in particular insects, arachnids and mites, which are found in enclosed spaces such as, for example, dwellings, factory halls, offices, vehicle cabins and the like. They can be employed in domestic insecticide products for controlling these pests alone or in combination with other active compounds and auxiliaries. They are active against sensitive and resistant species and against all development stages. These pests include:

15 From the order of the Scorpionidea, for example, *Buthus occitanus*.

From the order of the Acarina, for example, *Argas persicus*, *Argas reflexus*, *Bryobia* spp., *Dermanyssus gallinae*, *Glyciphagus domesticus*, *Ornithodoros moubat*, *Rhipicephalus sanguineus*, *Trombicula alfreddugesi*, *Neutrombicula autumnalis*, *Dermatophagoides pteronissimus*, *Dermatophagoides farinae*.

20 From the order of the Araneae, for example, *Aviculariidae*, *Araneidae*.

From the order of the Opiliones, for example, *Pseudoscorpiones chelifer*, *Pseudoscorpiones cheiridium*, *Opiliones phalangium*.

From the order of the Isopoda, for example, *Oniscus asellus*, *Porcellio scaber*.

From the order of the Diplopoda, for example, *Blaniulus guttulatus*, *Polydesmus* spp..

25 From the order of the Chilopoda, for example, *Geophilus* spp..

From the order of the Zygentoma, for example, *Ctenolepisma* spp., *Lepisma saccharina*, *Lepismodes inquilinus*.

From the order of the Blattaria, for example, *Blatta orientalis*, *Blattella germanica*, *Blattella asahinai*, *Leucophaea madera*, *Panchlora* spp., *Parcoblatta* spp., *Periplaneta australasiae*, *Periplaneta americana*, *Periplaneta brunnea*, *Periplaneta fuliginosa*, *Supella longipalpa*.

From the order of the Saltatoria, for example, *Acheta domesticus*.

From the order of the Dermaptera, for example, *Forficula auricularia*.

From the order of the Isoptera, for example, *Kalotermes spp.*, *Reticulitermes spp..*

From the order of the Psocoptera, for example, *Lepinatus spp.*, *Liposcelis spp..*

- 5 From the order of the Coleoptera, for example, *Anthrenus spp.*, *Attagenus spp.*, *Dermestes spp.*, *Latheticus oryzae*, *Necrobia spp.*, *Ptinus spp.*, *Rhizopertha dominica*, *Sitophilus granarius*, *Sitophilus oryzae*, *Sitophilus zeamais*, *Stegobium paniceum*.

From the order of the Diptera, for example, *Aedes aegypti*, *Aedes albopictus*, *Aedes taeniorhynchus*, *Anopheles spp.*, *Calliphora erythrocephala*, *Chrysozona pluvialis*, *Culex quinquefasciatus*, *Culex pipiens*, *Culex tarsalis*, *Drosophila spp.*, *Fannia canicularis*, *Musca domestica*, *Phlebotomus spp.*, *Sarcophaga carnaria*, *Simulium spp.*, *Stomoxys calcitrans*, *Tipula paludosa*.

10 From the order of the Lepidoptera, for example, *Achroia grisella*, *Galleria mellonella*, *Plodia interpunctella*, *Tinea cloacella*, *Tinea pellionella*, *Tineola bisselliella*.

- 15 From the order of the Siphonaptera, for example, *Ctenocephalides canis*, *Ctenocephalides felis*, *Pulex irritans*, *Tunga penetrans*, *Xenopsylla cheopis*.

From the order of the Hymenoptera, for example, *Camponotus herculeanus*, *Lasius fuliginosus*, *Lasius niger*, *Lasius umbratus*, *Monomorium pharaonis*, *Paravespula spp.*, *Tetramorium caespitum*.

20 From the order of the Anoplura, for example, *Pediculus humanus capitis*, *Pediculus humanus corporis*, *Phthirus pubis*.

From the order of the Heteroptera, for example, *Cimex hemipterus*, *Cimex lectularius*, *Rhodinus prolixus*, *Triatoma infestans*.

25 They are used in the household insecticides sector alone or in combination with other suitable active compounds such as phosphoric esters, carbamates, pyrethroids, neonicotinoids, growth regulators or active compounds from other known classes of insecticides.

They are used in aerosols, pressure-free spray products, for example pump and atomizer sprays, automatic fogging systems, foggers, foams, gels, evaporator products with evaporator tablets made of cellulose or polymer, liquid evaporators, gel and membrane evaporators, propeller-driven evaporators, energy-free, or passive, evaporation systems, moth papers, moth bags and moth gels, as granules or dusts, in baits for spreading or in bait stations.

The active compounds according to the invention can also be used as defoliants, desiccants, haulm killers and, in particular, as weed killers. Weeds in the broadest sense are understood as meaning all plants which grow at locations where they are undesired. Whether the substances according to the invention act as non-selective or selective herbicides depends essentially on the application rate.

5

The active compounds according to the invention can be used, for example, in the following plants:

Dicotyledonous weeds of the genera: Abutilon, Amaranthus, Ambrosia, Anoda, Anthemis, Aphanes, Atriplex, Bellis, Bidens, Capsella, Carduus, Cassia, Centaurea, Chenopodium, Cirsium, Convolvulus, Datura, Desmodium, Emex, Erysimum, Euphorbia, Galeopsis, Galinsoga, Galium, Hibiscus, Ipomoea, Kochia, Lamium, Lepidium, Lindernia, Matricaria, Mentha, Mercurialis, Mullugo, Myosotis, Papaver, Pharbitis, Plantago, Polygonum, Portulaca, Ranunculus, Raphanus, Rorippa, Rotala, Rumex, Salsola, Senecio, Sesbania, Sida, Sinapis, Solanum, Sonchus, Sphenoclea, Stellaria, Taraxacum, Thlaspi, Trifolium, Urtica, Veronica, Viola, Xanthium.

10

Dicotyledonous crops of the genera: Arachis, Beta, Brassica, Cucumis, Cucurbita, Helianthus, Daucus, Glycine, Gossypium, Ipomoea, Lactuca, Linum, Lycopersicon, Nicotiana, Phaseolus, Pisum, Solanum, Vicia.

15

Monocotyledonous weeds of the genera: Aegilops, Agropyron, Agrostis, Alopecurus, Apera, Avena, Brachiaria, Bromus, Cenchrus, Commelina, Cynodon, Cyperus, Dactyloctenium, Digitaria, Echinochloa, Eleocharis, Eleusine, Eragrostis, Eriochloa, Festuca, Fimbristylis, Heteranthera, Imperata, Ischaemum, Leptochloa, Lolium, Monochoria, Panicum, Paspalum, Phalaris, Phleum, Poa, Rottboellia, Sagittaria, Scirpus, Setaria, Sorghum.

20

Monocotyledonous crops of the genera: Allium, Ananas, Asparagus, Avena, Hordeum, Oryza, Panicum, Saccharum, Secale, Sorghum, Triticale, Triticum, Zea.

25

However, the use of the active compounds according to the invention is in no way restricted to these genera, but extends in the same manner to other plants.

30

Depending on the concentration, the active compounds according to the invention are suitable for the non-selective weed control on, for example, industrial terrains and railway tracks and on paths and locations with and without trees. Likewise the active compounds according to the invention can be employed for controlling weeds in perennial crops, for example forests, ornamental tree plantings, orchards, vineyards, citrus groves, nut orchards, banana plantations, coffee plantations, tea plantations, rubber plantations, oil palm plantations, cocoa plantations, soft fruit plantings and hop fields, on lawns, turf and pastureland, and for the selective control of weeds in annual crops.

The compounds of the formula (I) according to the invention have strong herbicidal activity and a broad activity spectrum when used on the soil and on aerial plant parts. To a certain extent, they are also suitable for the selective control of monocotyledonous and dicotyledonous weeds in monocotyledonous and dicotyledonous crops, both pre- and post-emergence.

- 5 At certain concentrations or application rates, the active compounds according to the invention can also be employed for controlling animal pests and fungal or bacterial plant diseases. If appropriate, they can also be used as intermediates or precursors for the synthesis of other active compounds.

The active compounds can be converted into the customary formulations, such as solutions, emulsions, wettable powders, suspensions, powders, dusting agents, pastes, soluble powders, granules, 10 suspoemulsion concentrates, natural and synthetic materials impregnated with active compound, and very fine capsules in polymeric substances.

These formulations are produced in a known manner, for example by mixing the active compounds with extenders, that is liquid solvents and/or solid carriers, optionally with the use of surfactants, that is emulsifiers and/or dispersants and/or foam-formers.

- 15 If the extender used is water, it is also possible to use, for example, organic solvents as auxiliary solvents. Suitable liquid solvents are essentially: aromatics, such as xylene, toluene or alkynaphthalenes, chlorinated aromatics and chlorinated aliphatic hydrocarbons, such as chlorobenzenes, chloroethylenes or methylene chloride, aliphatic hydrocarbons, such as cyclohexane or paraffins, for example petroleum fractions, mineral and vegetable oils, alcohols, such as butanol or glycol, and also 20 their ethers and esters, ketones, such as acetone, methyl ethyl ketone, methyl isobutyl ketone or cyclohexanone, strongly polar solvents, such as dimethylformamide and dimethyl sulphoxide, and also water.

- Suitable solid carriers are: for example ammonium salts and ground natural minerals, such as kaolins, clays, talc, chalk, quartz, attapulgite, montmorillonite or diatomaceous earth, and ground synthetic 25 minerals, such as finely divided silica, alumina and silicates, suitable solid carriers for granules are: for example crushed and fractionated natural rocks such as calcite, marble, pumice, sepiolite and dolomite, and also synthetic granules of inorganic and organic meals, and granules of organic material such as sawdust, coconut shells, maize cobs and tobacco stalks; suitable emulsifiers and/or foam-formers are: for example non-ionic and anionic emulsifiers, such as polyoxyethylene fatty acid 30 esters, polyoxyethylene fatty alcohol ethers, for example alkylaryl polyglycol ethers, alkylsulphonates, alkyl sulphates, arylsulphonates and protein hydrolysates; suitable dispersants are: for example lignosulphite waste liquors and methylcellulose.

Tackifiers such as carboxymethylcellulose and natural and synthetic polymers in the form of powders, granules or latices, such as gum arabic, polyvinyl alcohol and polyvinyl acetate, and also

natural phospholipids, such as cephalins and lecithins, and synthetic phospholipids, can be used in the formulations. Other possible additives are mineral and vegetable oils.

It is possible to use colorants such as inorganic pigments, for example iron oxide, titanium oxide and Prussian Blue, and organic dyestuffs, such as alizarin dyestuffs, azo dyestuffs and metal phthalocyanine dyestuffs, and trace nutrients such as salts of iron, manganese, boron, copper, cobalt, molybdenum and zinc.

The formulations generally comprise between 0.1 and 95 per cent by weight of active compound, preferably between 0.5 and 90%.

The active compounds according to the invention, as such or in their formulations, can also be used for weed control purposes as a mixture with known herbicides and/or with substances which improve crop plant tolerance ("safeners"), ready mixes or tank mixes being possible. Mixtures with herbicide products which contain one or more known herbicides and a safener are hence also possible.

Herbicides which are suitable for the mixtures are known herbicides, for example

acetochlor, acifluorfen (-sodium), aclonifen, alachlor, aloxydim (-sodium), ametryne, amicarbazone, amidochlor, amidosulfuron, anilofos, asulam, atrazine, azafenidin, azimsulfuron, beflubutamid, benazolin (-ethyl), benfuresate, bensulfuron (-methyl), bentazone, benzfendizone, benzobicyclon, benzofenap, benzoylprop (-ethyl), bialaphos, bifenoxy, bispyribac (-sodium), bromobutide, bromofenoxim, bromoxynil, butachlor, butafenacil (-allyl), butroxydim, butylate, cafenstrole, caloxydim, carbetamide, carfentrazone (-ethyl), chlomethoxyfen, chloramben, chloridazon, chlorimuron (-ethyl), chlornitrofen, chlorsulfuron, chlortoluron, cinidon (-ethyl), cinmethylin, cinosulfuron, clefoxydim, clethodim, clodinafop (-propargyl), clomazone, clomeprop, clopyralid, clopyrasulfuron (-methyl), cloransulam (-methyl), cumyluron, cyanazine, cybutryne, cycloate, cyclosulfamuron, cycloxydim, cyhalofop (-butyl), 2,4-D, 2,4-DB, desmedipham, diallate, dicamba, dichlorprop (-P), diclofop (-methyl), diclosulam, diethatyl (-ethyl), difenzoquat, diflufenican, diflufenopyr, dimefuron, dimepiperate, dimethachlor, dimethametryn, dimethenamid, dimexyflam, dinitramine, diphenamid, diquat, dithiopyr, diuron, dymron, epropanodan, EPTC, esprocarb, ethalfluralin, ethametsulfuron(-methyl), ethofumesate, ethoxyfen, ethoxysulfuron, etobenzanid, fenoxaprop (-P-ethyl), fentrazamide, flamprop (-isopropyl, -isopropyl-L, -methyl), flazasulfuron, florasulam, fluazifop (-P-butyl), fluazolate, flucarbazone (-sodium), flufenacet, flumetsulam, flumiclorac (-pentyl), flumioxazin, flumipropyn, flumetsulam, fluometuron, fluorochloridone, fluorglycofen (-ethyl), flupoxam, flupropacil, flurpyrsulfuron (-methyl, -sodium), flurenol (-butyl), fluridone, fluroxypyr (-butoxypropyl, -meptyl), flurprimidol, flurtamone, fluthiacet (-methyl), fluthiamide, fomesafen, foramsulfuron, glufosinate (-ammonium), glyphosate (-isopropylammonium), halosafen, haloxyfop (-ethoxyethyl, -P-methyl), hexazinone, imazamethabenz (-methyl), imaza-

methapyr, imazamox, imazapic, imazapyr, imazaquin, imazethapyr, imazosulfuron, iodosulfuron (-methyl, -sodium), ioxynil, isopropalin, isoproturon, isouron, isoxaben, isoxachlortole, isoxaflutole, isoxapryifop, lactofen, lenacil, linuron, MCPA, mecoprop, mefenacet, mesotrione, metamitron, metazachlor, methabenzthiazuron, metobenzuron, metobromuron, (alpha-) metolachlor, metosulam, metoxuron, metribuzin, metsulfuron (-methyl), molinate, monolinuron, naproanilide, napropamide, neburon, nicosulfuron, norflurazon, orbencarb, oryzalin, oxadiargyl, oxadiazon, oxasulfuron, oxaziclofone, oxyfluorfen, paraquat, pelargonic acid, pendimethalin, pendralin, pentoxazone, phenmedipham, picolinafen, piperophos, pretilachlor, primisulfuron (-methyl), profluazol, prometryn, propachlor, propanil, propaquazafop, propisochlor, propoxycarbazone (-sodium), propyzamide, prosulfocarb, prosulfuron, pyraflufen (-ethyl), pyrazogyl, pyrazolate, pyrazosulfuron (-ethyl), pyrazoxyfen, pyribenzoxim, pyributicarb, pyridate, pyridatol, pyriftalide, pyriminobac (-methyl), pyri thiobac (-sodium), quinchlorac, quinmerac, quinoclamine, quizalofop (-P-ethyl, -P-tefuryl), rimsulfuron, sethoxydim, simazine, simetryn, sulcotrione, sulfentrazone, sulfometuron (-methyl), sulfosate, sulfosulfuron, tebutam, tebuthiuron, tepraloxydim, terbutylazine, terbutryn, thenylchlor, thiafluamide, thiazopyr, thidiazimin, thifensulfuron (-methyl), thiobencarb, tiocarbazil, tralkoxydim, triallate, triasulfuron, tribenuron (-methyl), triclopyr, tridiphane, trifluralin, trifloxysulfuron, triflusulfuron (-methyl), tritosulfuron.

Also suitable for the mixtures are known safeners, for example:

AD-67, BAS-145138, benoxacor, cloquintocet (-mexyl), cyometrinil, 2,4-D, DKA-24, dichlormid, dymron, fenclorim, fenchlorazol (-ethyl), flurazole, fluxofenim, furilazole, isoxadifen (-ethyl), MCPA, mecoprop (-P), mefenpyr (-diethyl), MG-191, oxabetrinil, PPG-1292, R-29148.

A mixture with other known active compounds, such as fungicides, insecticides, acaricides, nematicides, bird repellents, plant nutrients and soil conditioners, is also possible.

The active compounds can be applied as such, in the form of their formulations or the use forms prepared therefrom by further dilution, such as ready-to-use solutions, suspensions, emulsions, powders, pastes and granules. They are applied in the customary manner, for example by pouring, spraying, atomizing, spreading.

The active compounds according to the invention can be applied both before and after plant emergence. They can also be incorporated into the soil prior to planting.

The application rate of active compound can vary within a substantial range. Essentially, it depends on the nature of the desired effect. In general, the application rates are between 1 g and 10 kg of active compound per hectare of soil area, preferably between 5 g and 5 kg per ha.

The substances according to the invention have potent microbicidal activity and can be employed for controlling unwanted microorganisms, such as fungi and bacteria, in crop protection and in the protection of materials.

Fungicides can be employed in crop protection for controlling Plasmodiophoromycetes, Oomycetes, Chytridiomycetes, Zygomycetes, Ascomycetes, Basidiomycetes and Deuteromycetes.

Bactericides can be employed in crop protection for controlling Pseudomonadaceae, Rhizobiaceae, Enterobacteriaceae, Corynebacteriaceae and Streptomycetaceae.

Some pathogens causing fungal and bacterial diseases which come under the generic names listed above may be mentioned as examples, but not by way of limitation:

- 10 Xanthomonas species, such as, for example, *Xanthomonas campestris* pv. *oryzae*;
 Pseudomonas species, such as, for example, *Pseudomonas syringae* pv. *lachrymans*;
 Erwinia species, such as, for example, *Erwinia amylovora*;
 Pythium species, such as, for example, *Pythium ultimum*;
 Phytophthora species, such as, for example, *Phytophthora infestans*;
- 15 *Pseudoperonospora* species, such as, for example, *Pseudoperonospora humuli* or
 Pseudoperonospora cubensis;
 Plasmopara species, such as, for example, *Plasmopara viticola*;
 Bremia species, such as, for example, *Bremia lactucae*;
 Peronospora species, such as, for example, *Peronospora pisi* or *P. brassicae*;
- 20 *Erysiphe* species, such as, for example, *Erysiphe graminis*;
 Sphaerotheca species, such as, for example, *Sphaerotheca fuliginea*;
 Podosphaera species, such as, for example, *Podosphaera leucotricha*;
 Venturia species, such as, for example, *Venturia inaequalis*;
 Pyrenophora species, such as, for example, *Pyrenophora teres* or *P. graminea*
- 25 (conidia form: *Drechslera*, syn: *Helminthosporium*);

Cochliobolus species, such as, for example, *Cochliobolus sativus*

(conidia form: *Drechslera*, syn: *Helminthosporium*);

Uromyces species, such as, for example, *Uromyces appendiculatus*;

Puccinia species, such as, for example, *Puccinia recondita*;

5 *Sclerotinia* species, such as, for example, *Sclerotinia sclerotiorum*;

Tilletia species, such as, for example, *Tilletia caries*;

Ustilago species, such as, for example, *Ustilago nuda* or *Ustilago avenae*;

Pellicularia species, such as, for example, *Pellicularia sasakii*;

Pyricularia species, such as, for example, *Pyricularia oryzae*;

10 *Fusarium* species, such as, for example, *Fusarium culmorum*;

Botrytis species, such as, for example, *Botrytis cinerea*;

Septoria species, such as, for example, *Septoria nodorum*;

Leptosphaeria species, such as, for example, *Leptosphaeria nodorum*;

Cercospora species, such as, for example, *Cercospora canescens*;

15 *Alternaria* species, such as, for example, *Alternaria brassicae*; and

Pseudocercospora species, such as, for example, *Pseudocercospora herpotrichoides*.

The active compounds according to the invention also have very good fortifying action in plants. Accordingly, they can be used for mobilizing the defences of the plant against attack by unwanted microorganisms.

20 In the present context, plant-fortifying (resistance-inducing) substances are to be understood as meaning those substances which are capable of stimulating the defence system of plants such that, when the treated plants are subsequently inoculated with unwanted microorganisms, they show substantial resistance against these microorganisms.

25 In the present case, undesirable microorganisms are to be understood as meaning phytopathogenic fungi, bacteria and viruses. Accordingly, the substances according to the invention can be used to protect plants for a certain period after the treatment against attack by the pathogens mentioned.

The period for which protection is provided generally extends over 1 to 10 days, preferably 1 to 7 days, after the treatment of the plants with the active compounds.

The fact that the active compounds are well tolerated by plants at the concentrations required for controlling plant diseases permits the treatment of above-ground parts of plants, of propagation stock and seeds, and of the soil.

5 The active compounds according to the invention are also suitable for increasing the yield of crops. In addition, they show reduced toxicity and are well tolerated by plants.

At certain concentrations and application rates, the active compounds according to the invention can also be used as herbicides, for influencing plant growth and for controlling animal pests. If 10 appropriate, they can also be used as intermediates and precursors for the synthesis of further active compounds.

In the protection of materials, the compounds according to the invention can be employed for protecting industrial materials against infection with, and destruction by, unwanted microorganisms.

15 Industrial materials in the present context are understood as meaning non-living materials which have been prepared for use in industry. For example, industrial materials which are intended to be protected by active compounds according to the invention from microbial change or destruction can be adhesives, sizes, paper and board, textiles, leather, wood, paints and plastic articles, cooling lubricants and other materials which can be infected with, or destroyed by, microorganisms. Parts 20 of production plants, for example cooling-water circuits, which may be impaired by the proliferation of microorganisms may also be mentioned within the scope of the materials to be protected. Industrial materials which may be mentioned within the scope of the present invention are preferably adhesives, sizes, paper and board, leather, wood, paints, cooling lubricants and heat-transfer liquids, particularly preferably wood.

25 Microorganisms capable of degrading or changing the industrial materials which may be mentioned are, for example, bacteria, fungi, yeasts, algae and slime organisms. The active compounds according to the invention preferably act against fungi, in particular moulds, wood-discolouring and wood-destroying fungi (Basidiomycetes), and against slime organisms and algae.

Microorganisms of the following genera may be mentioned as examples:

30 Alternaria, such as *Alternaria tenuis*,

Aspergillus, such as *Aspergillus niger*,

Chaetomium, such as *Chaetomium globosum*,

- Coniophora, such as Coniophora puetana,
- Lentinus, such as Lentinus tigrinus,
- Penicillium, such as Penicillium glaucum,
- Polyporus, such as Polyporus versicolor,
- 5 Aureobasidium, such as Aureobasidium pullulans,
- Sclerophoma, such as Sclerophoma pityophila,
- Trichoderma, such as Trichoderma viride,
- Escherichia, such as Escherichia coli,
- Pseudomonas, such as Pseudomonas aeruginosa, and
- 10 Staphylococcus, such as Staphylococcus aureus.
- Depending on their particular physical and/or chemical properties, the active compounds can be converted into the customary formulations, such as solutions, emulsions, suspensions, powders, foams, pastes, granules, aerosols and microencapsulations in polymeric substances and in coating compositions for seeds, and ULV cool and warm fogging formulations.
- 15 These formulations are produced in a known manner, for example by mixing the active compounds with extenders, that is liquid solvents, liquefied gases under pressure, and/or solid carriers, optionally with the use of surfactants, that is emulsifiers and/or dispersants, and/or foam formers. If the extender used is water, it is also possible to employ, for example, organic solvents as auxiliary solvents. Essentially, suitable liquid solvents are: aromatics such as xylene, toluene or
- 20 alkynaphthalenes, chlorinated aromatics or chlorinated aliphatic hydrocarbons such as chlorobenzenes, chloroethylenes or methylene chloride, aliphatic hydrocarbons such as cyclohexane or paraffins, for example petroleum fractions, alcohols such as butanol or glycol and their ethers and esters, ketones such as acetone, methyl ethyl ketone, methyl isobutyl ketone or cyclohexanone, strongly polar solvents such as dimethylformamide and dimethyl sulphoxide, or
- 25 else water. Liquefied gaseous extenders or carriers are to be understood as meaning liquids which are gaseous at standard temperature and under atmospheric pressure, for example aerosol propellants such as halogenated hydrocarbons, or else butane, propane, nitrogen and carbon dioxide. Suitable solid carriers are: for example ground natural minerals such as kaolins, clays, talc, chalk, quartz, attapulgite, montmorillonite or diatomaceous earth, and ground synthetic
- 30 minerals such as finely divided silica, alumina and silicates. Suitable solid carriers for granules are: for example crushed and fractionated natural rocks such as calcite, marble, pumice, sepiolite

and dolomite, or else synthetic granules of inorganic and organic meals, and granules of organic material such as sawdust, coconut shells, maize cobs and tobacco stalks. Suitable emulsifiers and/or foam formers are: for example nonionic and anionic emulsifiers, such as polyoxyethylene fatty acid esters, polyoxyethylene fatty alcohol ethers, for example alkylaryl polyglycol ethers, alkylsulphonates, alkyl sulphates, arylsulphonates, or else protein hydrolysates. Suitable dispersants are: for example lignosulphite waste liquors and methylcellulose.

Tackifiers such as carboxymethylcellulose and natural and synthetic polymers in the form of powders, granules or latices, such as gum arabic, polyvinyl alcohol and polyvinyl acetate, or else natural phospholipids such as cephalins and lecithins and synthetic phospholipids can be used in the formulations. Other possible additives are mineral and vegetable oils.

It is possible to use colorants such as inorganic pigments, for example iron oxide, titanium oxide and Prussian Blue, and organic dyestuffs such as alizarin dyestuffs, azo dyestuffs and metal phthalocyanine dyestuffs, and trace nutrients such as salts of iron, manganese, boron, copper, cobalt, molybdenum and zinc.

15 The formulations generally comprise between 0.1 and 95 per cent by weight of active compound, preferably between 0.5 and 90%.

The active compounds according to the invention can be used as such or in their formulations, also in a mixture with known fungicides, bactericides, acaricides, nematicides or insecticides, to broaden, for example, the activity spectrum or to prevent development of resistance. In many 20 cases, synergistic effects are obtained, i.e. the activity of the mixture is greater than the activity of the individual components.

Examples of suitable mixing components are the following:

Fungicides:

25 2-phenylphenol; 8-hydroxyquinoline sulphate; acibenzolar-S-methyl; aldimorph; amidoflumet; ampropylfos; ampropylfos-potassium; andoprim; anilazine; azaconazole; azoxystrobin; benalaxyl; benodanil; benomyl; benthiavalicarb-isopropyl; benzamacril; benzamacril-isobutyl; bilanafos; binapacryl; biphenyl; bitertanol; blasticidin-S; bromuconazole; bupirimate; buthiobate; butylamine; calcium polysulphide; capsimycin; captafol; captan; carbendazim; carboxin; carpropamid; carvone; chinomethionat; chlobenthiazole; chlorfenazole; chloroneb; chlorothalonil; chlozolinate; clozylacon; cyazofamid; cyflufenamid; cymoxanil; cyproconazole; cyprodinil; cyprofuram; Dagger G; debacarb; dichlofluanid; dichlone; dichlorophen; diclocymet; diclomezine; dicloran; diethofencarb; difenoconazole; diflumetorim; dimethirimol; dimethomorph; dimoxystrobin; diniconazole; diniconazole-M; dinocap; diphenylamine; dipyridithione; ditalimfos; dithianon; dodine; drazoxolon; edifenphos; epoxiconazole; ethaboxam; ethirimol; etridiazole;

famoxadone; fenamidone; fenapanil; fenarimol; fenbuconazole; fenfuram; fenhexamid; fenitropan; fenoxanil; fenpiclonil; fenpropidin; fenpropimorph; ferbam; fluazinam; flubenzimine; fludioxonil; flumetover; flumorph; fluoromide; fluoxastrobin; fluquinconazole; flurprimidol; flusilazole; flusulfamide; flutolanil; flutriafol; folpet; fosetyl-Al; fosetyl-sodium; fuberidazole; furalaxyd; furametpyr; furcarbanil; furmecyclox; guazatine; hexachlorobenzene; hexaconazole; hymexazole; imazalil; imibenconazole; iminoctadine triacetate; iminoctadine tris(albesil); iodocarb; ipconazole; iprobenfos; iprodione; iprovalicarb; irumamycin; isoprothiolane; isovaliedione; kasugamycin; kresoxim-methyl; mancozeb; manebe; meferimzone; mepanipyrim; mepronil; metalaxyl; metalaxyl-M; metconazole; methasulfocarb; methfuroxam; metiram; metominostrobin; metsulfovax; mildiomycin; myclobutanil; myclozolin; natamycin; nicobifen; nitrothal-isopropyl; noviflumuron; nuarimol; ofurace; orysastrobin; oxadixyl; oxolinic acid; oxpoconazole; oxycarboxin; oxyfenthiin; paclobutrazole; pefurazoate; penconazole; pencycuron; phosdiphen; phthalide; picoxystrobin; piperalin; polyoxins; polyoxorim; probenazole; prochloraz; procymidone; propamocarb; propanosine-sodium; propiconazole; propineb; proquinazid; prothioconazole; pyraclostrobin; pyrazophos; pyrifenoxy; pyrimethanil; pyroquilon; pyrooxyfur; pyrrolenitrine; quinconazole; quinoxyfen; quintozene; simeconazole; spiroxamine; sulphur; tebuconazole; tecloftalam; tecnazene; tetcyclacis; tetaconazole; thiabendazole; thicyofen; thifluzamide; thiophanate-methyl; thiram; tioxymid; tolclofos-methyl; tolylfluanid; triadimefon; triadimenol; triazbutil; triazoxide; tricyclamide; tricyclazole; tridemorph; trifloxystrobin; triflumizole; triforine; triticonazole; uniconazole; validamycin A; vinclozolin; zineb; ziram; zoxamide; (2S)-N-[2-[4-[[3-(4-chlorophenyl)-2-propynyl]oxy]-3-methoxyphenyl]ethyl]-3-methyl-2-[(methylsulphonyl)amino]-butanamide; 1-(1-naphthalenyl)-1H-pyrrole-2,5-dione; 2,3,5,6-tetrachloro-4-(methylsulphonyl)-pyridine; 2-amino-4-methyl-N-phenyl-5-thiazolecarboxamide; 2-chloro-N-(2,3-dihydro-1,1,3-trimethyl-1H-inden-4-yl)-3-pyridinecarboxamide; 3,4,5-trichloro-2,6-pyridinedicarbonitrile; actinovate; cis-1-(4-chlorophenyl)-2-(1H-1,2,4-triazol-1-yl)cycloheptanol; methyl 1-(2,3-dihydro-2,2-dimethyl-1H-inden-1-yl)-1H-imidazole-5-carboxylate; monopotassium carbonate; N-(6-methoxy-3-pyridinyl)cyclopropanecarboxamide; N-butyl-8-(1,1-dimethylethyl)-1-oxaspiro-[4.5]decane-3-amine; sodium tetrathiocarbonate;

and copper salts and preparations, such as Bordeaux mixture; copper hydroxide; copper naphthenate; copper oxychloride; copper sulphate; cufraneb; cuprous oxide; mancopper; oxine-copper.

Bactericides:

35 bronopol, dichlorophen, nitrapyrin, nickel dimethyldithiocarbamate, kasugamycin, octhilinone, furancarboxylic acid, oxytetracyclin, probenazole, streptomycin, tecloftalam, copper sulphate and other copper preparations.

Insecticides/acaricides/nematicides:

abamectin, ABG-9008, acephate, acequinocyl, acetamiprid, acetoprole, acrinathrin, AKD-1022, AKD-3059, AKD-3088, alanycarb, aldicarb, aldoxycarb, allethrin, allethrin 1R-isomers, alpha-cypermethrin (alphamethrin), amidoflumet, aminocarb, amitraz, avermectin, AZ-60541, azadirachtin, azamethiphos, azinphos-methyl, azinphos-ethyl, azocyclotin,

Bacillus popilliae, Bacillus sphaericus, Bacillus subtilis, Bacillus thuringiensis, Bacillus thuringiensis strain EG-2348, Bacillus thuringiensis strain GC-91, Bacillus thuringiensis strain NCTC-11821, baculoviruses, Beauveria bassiana, Beauveria tenella, bendiocarb, benfuracarb, bensultap, benzoximate, beta-cyfluthrin, beta-cypermethrin, bifenazate, bifenthrin, binapacyl, bioallethrin, bioallethrin-S-cyclopentyl-isomer, bioethanomethrin, biopermethrin, bioresmethrin, bistrifluron, BPMC, brofenprox, bromophos-ethyl, bromopropylate, bromfenvinfos (-methyl), BTG-504, BTG-505, bufencarb, buprofezin, butathiofos, butocarboxim, butoxycarboxim, butylpyridaben,

cadusafos, camphechlor, carbaryl, carbofuran, carbophenothion, carbosulfan, cartap, CGA-50439, chinomethionat, chlordane, chlordimeform, chloethocarb, chlorethoxyfos, chlorfenapyr, chlorfenvinphos, chlorfluazuron, chlormephos, chlorobenzilate, chloropicrin, chlorproxyfen, chlorpyrifos-methyl, chlorpyrifos (-ethyl), chlovaporthrin, chromafenozone, cis-cypermethrin, cis-resmethrin, cis-permethrin, clopythrin, cloethocarb, clofentezine, clothianidin, clothiazaben, codlemone, coumaphos, cyanofenphos, cyanophos, cycloprene, cycloprothrin, Cydia pomonella, cyfluthrin, cyhalothrin, cyhexatin, cypermethrin, cyphenothon (1R-trans-isomer), cyromazine,

DDT, deltamethrin, demeton-S-methyl, demeton-S-methylsulphone, diafenthuron, dialifos, diazinon, dichlofenthion, dichlorvos, dicofol, dicrotophos, dicyclanil, diflubenzuron, dimethoate, dimethylvinphos, dinobuton, dinocap, dinotefuran, diofenolan, disulfoton, docusat-sodium, dofenapyn, DOWCO-439,

eflusilanate, emamectin, emamectin-benzoate, empenthrin (1R-isomer), endosulfan, Entomophthora spp., EPN, esfenvalerate, ethiofencarb, ethiprole, ethion, ethoprophos, etofenprox, etoxazole, etrimfos,

famphur, fenamiphos, fenazaquin, fenbutatin oxide, fenfluthrin, fenitrothion, fenobucarb, fenothiocarb, fenoxacrim, fenoxy carb, fenpropathrin, fenpyrad, fenpyrithrin, fenpyroximate, fensulfothion, fenthion, fentrifanil, fenvalerate, fipronil, flonicamid, fluacrypyrim, fluazuron, flubenzimine, flubrocythrinate, flucycloxuron, flucythrinate, flufenerim, flufenoxuron, flufenprox, flumethrin, flupyrazofos, flutenzin (flusenzine), fluvalinate, fonofos, formetanate, formothion, fosmethilan, fosthiazate, fubfenprox (fluproxyfen), furathiocarb,

gamma-HCH, gossyplure, grandlure, granulosis viruses,

halfenprox, halofenozone, HCH, HCN-801, heptenophos, hexaflumuron, hexythiazox, hydramethylnone, hydroprene,

IKA-2002, imidacloprid, imiprothrin, indoxacarb, iodofenphos, iprobenfos, isazofos, isofenphos, isoprocarb, isoxathion, ivermectin,

5 japonilure,

kadethrin, nuclear polyhedrosis viruses, kinoprene,

lambda-cyhalothrin, lindane, lufenuron,

malathion, mecarbam, mesulfenfos, metaldehyde, metam-sodium, methacrifos, methamidophos, Metharhizium anisopliae, Metharhizium flavoviride, methidathion, methiocarb, methomyl,

10 methoprene, methoxychlor, methoxyfenozide, metolcarb, metoxadiazone, mevinphos, milbemectin, milbemycin, MKI-245, MON-45700, monocrotophos, moxidectin, MTI-800,

naled, NC-104, NC-170, NC-184, NC-194, NC-196, niclosamide, nicotine, nitenpyram, nithiazine, NNI-0001, NNI-0101, NNI-0250, NNI-9768, novaluron, noviflumuron,

15 OK-5101, OK-5201, OK-9601, OK-9602, OK-9701, OK-9802, omethoate, oxamyl, oxydemeton-methyl,

Paecilomyces fumosoroseus, parathion-methyl, parathion (-ethyl), permethrin (cis-, trans-), petroleum, PH-6045, phenothrin (1R-trans isomer), phentoate, phorate, phosalone, phosmet, phosphamidon, phosphocarb, phoxim, piperonyl butoxide, pirimicarb, pirimiphos-methyl, pirimiphos-ethyl, prallethrin, profenofos, promecarb, propaphos, propargite, propetamphos, 20 propoxur, prothiofos, prothoate, protrifenbute, pymetrozine, pyraclofos, pyresmethrin, pyrethrum, pyridaben, pyridalyl, pyridaphenthion, pyridathion, pyrimidifen, pyriproxyfen,

quinalphos,

resmethrin, RH-5849, ribavirin, RU-12457, RU-15525,

S-421, S-1833, salithion, sebufos, SI-0009, silafluofen, spinosad, spirodiclofen, spiromesifen, 25 sulfluramid, sulfotep, sulprofos, SZI-121,

tau-fluvalinate, tebufenozone, tebufenpyrad, tebupirimfos, teflubenzuron, tefluthrin, temephos, temivinphos, terbam, terbufos, tetrachlorvinphos, tetradifon, tetramethrin, tetramethrin (1R-isomer), tetrasul, theta-cypermethrin, thiacloprid, thiamethoxam, thiapronil, thiatriphos, thiocyclam hydrogen oxalate, thiodicarb, thiofanox, thiometon, thiosultap-sodium, thuringiensin, 30 tolfenpyrad, tralocythrin, tralomethrin, transfluthrin, triarathene, triazamate, triazophos, triazuron,

trichlophenidine, trichlorfon, triflumuron, trimethacarb,

vamidothion, vaniliprole, verbutin, Verticillium lecanii,

WL-108477, WL-40027,

YI-5201, YI-5301, YI-5302,

5 XMC, xylylcarb,

ZA-3274, zeta-cypermethrin, zolaprofos, ZXI-8901,

the compound 3-methylphenyl propylcarbamate (tsumacide Z),

the compound 3-(5-chloro-3-pyridinyl)-8-(2,2,2-trifluoroethyl)-8-azabicyclo[3.2.1]octane-3-carbo-

nitrile (CAS-Reg. No. 185982-80-3) and the corresponding 3-endo-isomer (CAS-Reg. No. 185984-

10 60-5) (cf. WO-96/37494, WO-98/25923),

and preparations which comprise insecticidally active plant extracts, nematodes, fungi or viruses.

A mixture with other known active compounds, such as herbicides, or with fertilizers and growth regulators, is also possible.

In addition, the compounds of the formula (I) according to the invention also have very good

15 antimycotic activity. They have a very broad antimycotic activity spectrum in particular against dermatophytes and yeasts, moulds and diphasic fungi (for example against Candida species, such as Candida albicans, Candida glabrata), and Epidermophyton floccosum, Aspergillus species, such as Aspergillus niger and Aspergillus fumigatus, Trichophyton species, such as Trichophyton mentagrophytes,

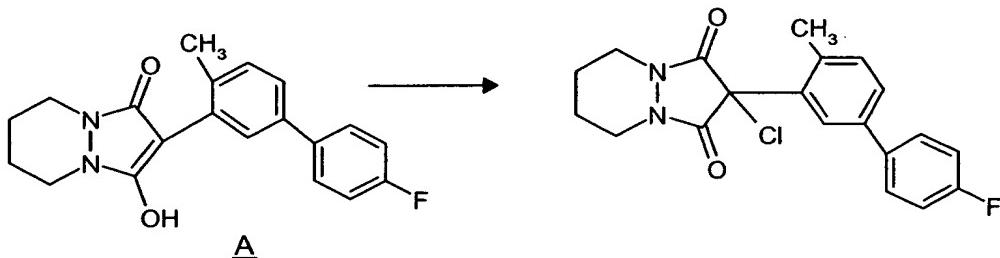
20 Microsporon species such as Microsporon canis and audouinii. The list of these fungi by no means limits the mycotic spectrum covered, but is only for illustration.

The active compounds can be used as such, in the form of their formulations or the use forms prepared therefrom, such as ready-to-use solutions, suspensions, wettable powders, pastes, soluble powders, dusts and granules. Application is carried out in a customary manner, for example by watering, spraying, atomizing, broadcasting, dusting, foaming, spreading, etc. It is furthermore possible to apply the active compounds by the ultra-low-volume method, or to inject the active compound preparation or the active compound itself into the soil. It is also possible to treat the seeds of the plants.

When using the active compounds according to the invention as fungicides, the application rates can be varied within a relatively wide range, depending on the kind of application. For the

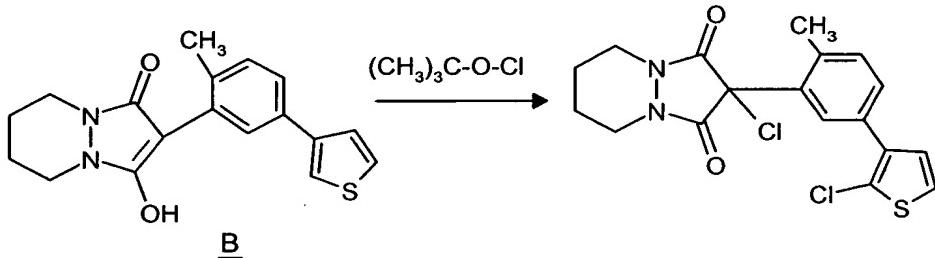
treatment of parts of plants, the active compound application rates are generally between 0.1 and 10 000 g/ha, preferably between 10 and 1000 g/ha. For seed dressing, the active compound application rates are generally between 0.001 and 50 g per kilogram of seed, preferably between 0.01 and 10 g per kilogram of seed. For the treatment of the soil, the active compound application rates are generally between 0.1 and 10 000 g/ha, preferably between 1 and 5000 g/ha.

The preparation and the use of the active compounds according to the invention is illustrated by the examples below.

Preparation Examples**Example I-1-1**

5 0.7 g (2.1 mmol) of compound A is dissolved in chloroform (30 ml) and, at room temperature, a solution of 0.56 g (4.2 mmol) of sulphuryl chloride in 10 ml of chloroform is added. The mixture is stirred at room temperature overnight, more sulphuryl chloride (0.28 g; 2.1 mmol) is added and the mixture is stirred for a further 8 hours. The mixture is diluted with 100 ml of chloroform and washed in each case once with water, saturated bicarbonate solution and saturated sodium chloride solution, and the organic phase is dried over sodium sulphate. After filtration and removal of the
10 solvent under reduced pressure, the oily residue is crystallized by ether, filtered off with suction and air-dried.

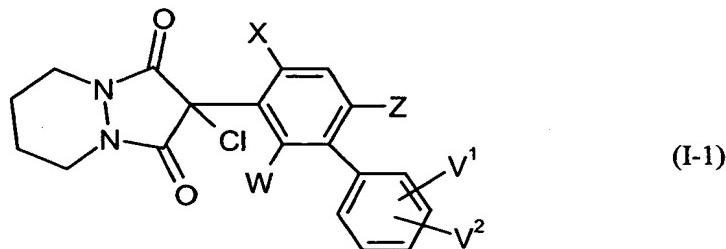
Yield: 0.5 g (65% of theory); colourless solid; m.p. 149°C.

Example I-1-2

15 0.4 g (1.23 mmol) of compound B is dissolved in 20 ml of anhydrous tetrahydrofuran (THF) and, at room temperature, a solution of 0.16 g (1.47 mmol) of tert-butyl hypochlorite in 5 ml of anhydrous THF is added. The mixture is stirred at room temperature for 12 hours, another portion of 0.16 g of tert-butyl hypochlorite (1.47 mmol) is added and the mixture is stirred at room temperature for another 12 hours. The solution is then concentrated and the residue is crystallized
20 using diethyl ether.

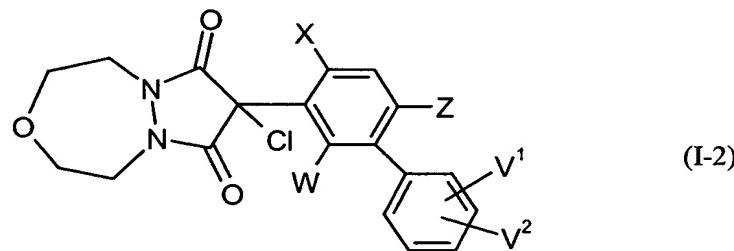
Yield: 0.25 g (57% of theory); colourless solid; m.p. 125°C.

The following examples of the formulae (I-1) to (I-4) are obtained analogously to Examples (I-1-1) and (I-1-2):



| Ex. No. | W | X | Z | V^1 | V^2 | m.p. (°C) |
|---------|---|---------------|---|---|--------------|-----------|
| I-1-3 | H | CH_3 | H | H | H | oil |
| I-1-4 | H | CH_3 | H | 2-Cl | H | 166 |
| I-1-5 | H | CH_3 | H | 3-Cl | H | oil |
| I-1-6 | H | CH_3 | H | 4-Cl | H | oil |
| I-1-7 | H | CH_3 | H | 2-F | H | oil |
| I-1-8 | H | CH_3 | H | 3-F | H | oil |
| I-1-9 | H | CH_3 | H | 2- CH_3 | H | 156 |
| I-1-10 | H | CH_3 | H | 3- CH_3 | H | oil |
| I-1-11 | H | CH_3 | H | 4- CH_3 | H | 153 |
| I-1-12 | H | CH_3 | H | 2-Cl | 3-Cl | 148 |
| I-1-13 | H | CH_3 | H | 2-Cl | 4-Cl | 172 |
| I-1-14 | H | CH_3 | H | 2-Cl | 5-Cl | oil |
| I-1-15 | H | CH_3 | H | 3-Cl | 4-Cl | oil |
| I-1-16 | H | CH_3 | H | 3-Cl | 5-Cl | oil |
| I-1-17 | H | CH_3 | H | 2-F | 4F | oil |
| I-1-18 | H | CH_3 | H | 2-F | 5-F | oil |
| I-1-19 | H | CH_3 | H | 3-Cl | 4-F | oil |
| I-1-20 | H | CH_3 | H | 2- CF_3 | H | |
| I-1-21 | H | CH_3 | H | 3- CF_3 | H | 117 |
| I-1-22 | H | CH_3 | H | 4- CF_3 | H | 156 |
| I-1-23 | H | CH_3 | H | 2-OCH ₃ | H | 166 |
| I-1-24 | H | CH_3 | H | 3-OCH ₃ | H | |
| I-1-25 | H | CH_3 | H | 4-OCH ₃ | H | 139 |
| I-1-26 | H | CH_3 | H | 3-SO ₂ C ₂ H ₅ | H | 177 |
| I-1-27 | H | CH_3 | H | 4-SO ₂ C ₂ H ₅ | H | 157 |

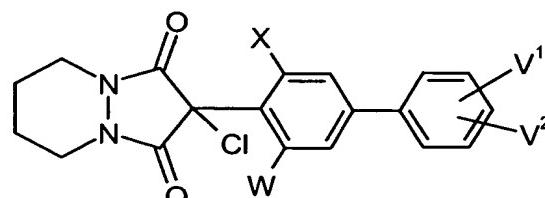
| Ex.No. | W | X | Z | V ¹ | V ² | m.p. (°C) |
|--------|-----------------|-----------------|-----------------|-----------------------------------|--------------------|-----------|
| I-1-28 | H | CH ₃ | H | 3-NO ₂ | H | |
| I-1-29 | H | CH ₃ | H | 4-OCF ₃ | H | 136 |
| I-1-30 | H | CH ₃ | H | 4-OPh | H | oil |
| I-1-31 | H | CH ₃ | H | 4-S-CH ₃ | H | |
| I-1-32 | H | CH ₃ | H | 4-i-C ₃ H ₇ | H | oil |
| I-1-33 | H | CH ₃ | H | 3-CF ₃ | 5-CF ₃ | |
| I-1-34 | H | CH ₃ | H | 2-OCH ₃ | 5-Cl | 138 |
| I-1-35 | H | CH ₃ | H | 2-Cl | 5-OCH ₃ | 179 |
| I-1-36 | H | CH ₃ | CH ₃ | 4-Cl | H | 136 |
| I-1-37 | CH ₃ | CH ₃ | H | 4-Cl | H | oil |
| I-1-38 | CH ₃ | CH ₃ | H | 4-F | H | oil |
| I-1-39 | H | Cl | H | 4-CF ₃ | H | 178 |
| I-1-40 | H | Cl | H | 4-Cl | H | 160 |
| I-1-41 | CH ₃ | CH ₃ | H | H | H | oil |
| I-1-42 | H | Cl | H | 4-F | H | oil |
| I-1-43 | CH ₃ | CH ₃ | CH ₃ | 4-Cl | H | oil |
| I-1-44 | H | Cl | H | 3-Cl | 5-Cl | 210 |
| I-1-45 | H | Cl | H | 2-Cl | 5-Cl | oil |
| I-1-46 | H | Cl | H | 3-Cl | 4-F | oil |
| I-1-47 | H | Cl | H | 2-F | 4-F | oil |
| I-1-48 | H | Cl | H | 3-Cl | 4-Cl | oil |



| Ex.No. | W | X | Z | V ¹ | V ² | m.p. (°C) |
|--------|---|-----------------|---|----------------|----------------|-----------|
| I-2-1 | H | CH ₃ | H | H | H | oil |
| I-2-2 | H | CH ₃ | H | 2-Cl | H | 169 |
| I-2-3 | H | CH ₃ | H | 3-Cl | H | 158 |
| I-2-4 | H | CH ₃ | H | 4-Cl | H | oil |
| I-2-5 | H | CH ₃ | H | 2-F | H | oil |

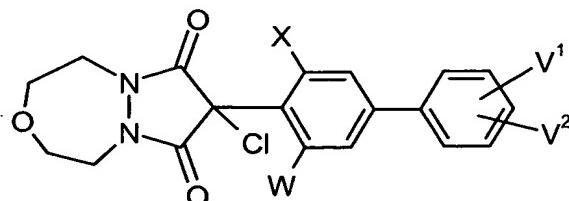
| Ex. No. | W | X | Z | V ¹ | V ² | m.p. (°C) |
|---------|-----------------|-----------------|-----------------|---|--------------------|-----------|
| I-2-6 | H | CH ₃ | H | 3-F | H | oil |
| I-2-7 | H | CH ₃ | H | 4-F | H | 145 |
| I-2-8 | H | CH ₃ | H | 2-CH ₃ | H | oil |
| I-2-9 | H | CH ₃ | H | 3-CH ₃ | H | 176 |
| I-2-10 | H | CH ₃ | H | 4-CH ₃ | H | 99 |
| I-2-11 | H | CH ₃ | H | 2-Cl | 3-Cl | 157 |
| I-2-12 | H | CH ₃ | H | 2-Cl | 4-Cl | 156 |
| I-2-13 | H | CH ₃ | H | 2-Cl | 5-Cl | 185 |
| I-2-14 | H | CH ₃ | H | 3-Cl | 4-Cl | 207 |
| I-2-15 | H | CH ₃ | H | 3-Cl | 5-Cl | oil |
| I-2-16 | H | CH ₃ | H | 2-F | 4-F | 162 |
| I-2-17 | H | CH ₃ | H | 2-F | 5-F | 166 |
| I-2-18 | H | CH ₃ | H | 3-Cl | 4-F | 173 |
| I-2-19 | H | CH ₃ | H | 2-CF ₃ | H | 159 |
| I-2-20 | H | CH ₃ | H | 3-CF ₃ | H | 163 |
| I-2-21 | H | CH ₃ | H | 4-CF ₃ | H | 200 |
| I-2-22 | H | CH ₃ | H | 2-OCH ₃ | H | 222 |
| I-2-23 | H | CH ₃ | H | 3-OCH ₃ | 6-Cl | |
| I-2-24 | H | CH ₃ | H | 4-OCH ₃ | H | |
| I-2-25 | H | CH ₃ | H | 3-SO ₂ C ₂ H ₅ | H | oil |
| I-2-26 | H | CH ₃ | H | 4-SO ₂ C ₂ H ₅ | H | oil |
| I-2-27 | H | CH ₃ | H | 3-NO ₂ | H | oil |
| I-2-28 | H | CH ₃ | H | 4-OCF ₃ | H | 162 |
| I-2-29 | H | CH ₃ | H | 4-OPh | H | 198 |
| I-2-30 | H | CH ₃ | H | 4-SCH ₃ | H | |
| I-2-31 | H | CH ₃ | H | 4-i-C ₃ H ₇ | H | oil |
| I-2-32 | H | CH ₃ | H | 3-CF ₃ | 5-CF ₃ | oil |
| I-2-33 | H | CH ₃ | H | 2-Cl | 5-OCH ₃ | 181 |
| I-2-34 | H | CH ₃ | H | 4-O-(4-Cl-Ph) | H | oil |
| I-2-35 | H | CH ₃ | H | 3-Cl | 4-OCH ₃ | 210 |
| I-2-36 | H | CH ₃ | CH ₃ | 4-Cl | H | 173 |
| I-2-37 | CH ₃ | CH ₃ | H | 4-Cl | H | 111 |
| I-2-38 | CH ₃ | CH ₃ | H | 4-F | H | oil |
| I-2-39 | H | Cl | H | 4-Cl | H | oil |

| Ex. No. | W | X | Z | V ¹ | V ² | m.p. (°C) |
|---------|-----------------|-----------------|-----------------|----------------|----------------|-----------|
| I-2-40 | H | Cl | H | 4-F | H | 171 |
| I-2-41 | CH ₃ | CH ₃ | CH ₃ | 4-Cl | H | 129 |
| I-2-42 | H | Cl | H | 2-Cl | 4-Cl | 197 |
| I-2-43 | H | Cl | H | 3-Cl | 5-Cl | 205 |
| I-2-44 | H | Cl | H | 2-F | 4-F | 193 |
| I-2-45 | H | Cl | H | 3-Cl | 4-F | 196 |
| I-2-46 | H | Cl | H | 2-Cl | 5-Cl | 180 |



(I-3)

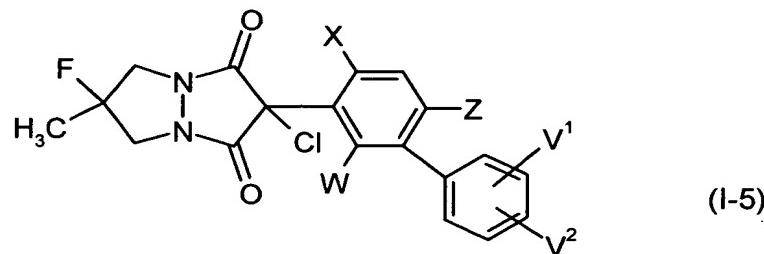
| Ex. No. | W | X | V ¹ | V ² | m.p. °C |
|---------|-------------------------------|-------------------------------|-------------------|----------------|---------|
| I-3-1 | CH ₃ | CH ₃ | 4-Cl | H | 173 |
| I-3-2 | H | CH ₃ | F | H | 172 |
| I-3-3 | CH ₃ | Cl | 4-Cl | H | 170 |
| I-3-5 | C ₂ H ₅ | Cl | 4-F | H | 113 |
| I-3-5 | CH ₃ | C ₂ H ₅ | 4-Cl | H | oil |
| I-3-6 | C ₂ H ₅ | Cl | 4-Cl | H | oil |
| I-3-7 | H | CH ₃ | 4-Cl | H | 146-149 |
| I-3-8 | CH ₃ | CH ₃ | 4-F | H | 145 |
| I-3-9 | CH ₃ | CH ₃ | 4-CF ₃ | H | 165 |



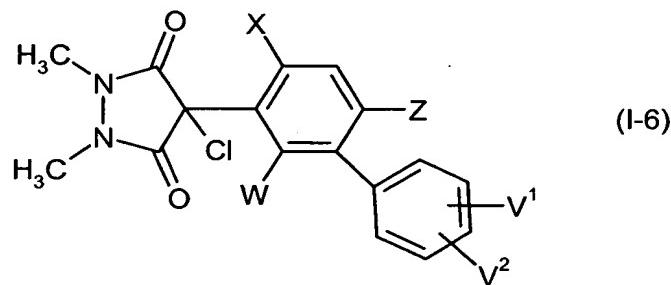
(I-4)

| Ex. No. | W | X | V ¹ | V ² | m.p. °C |
|---------|-----------------|-----------------|----------------|----------------|---------|
| I-4-1 | CH ₃ | CH ₃ | 4-Cl | H | 181 |
| I-4-2 | H | CH ₃ | 4-F | H | 168 |
| I-4-3 | CH ₃ | Cl | 4-Cl | H | 192 |

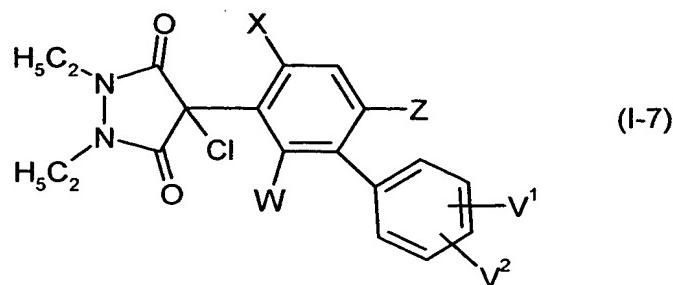
| | | | | | |
|-------|-------------------------------|-------------------------------|------|---|-----|
| I-4-4 | CH ₃ | C ₂ H ₅ | 4-Cl | H | oil |
| I-4-5 | CH ₃ | CH ₃ | 4-F | H | 160 |
| I-4-6 | C ₂ H ₅ | Cl | 4-Cl | H | oil |
| I-4-7 | C ₂ H ₅ | Cl | 4-F | H | 70 |
| I-4-8 | H | CH ₃ | 4-Cl | H | 164 |



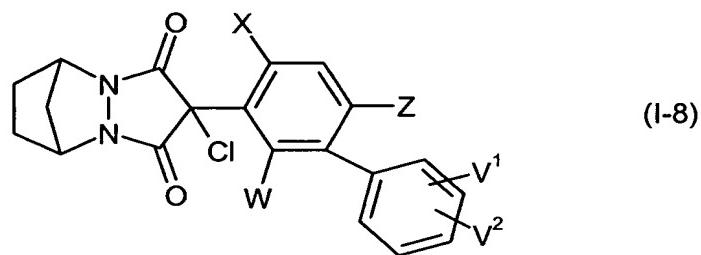
| Ex. No. | W | X | Z | V ¹ | V ² | m.p. °C |
|---------|---|-----------------|---|----------------|----------------|---------|
| I-5-1 | H | CH ₃ | H | 4-F | H | oil |
| I-5-2 | H | Cl | H | 4-F | H | oil |
| I-5-3 | H | Cl | H | 4-Cl | H | 172-173 |



| Ex. No. | W | X | Z | V ¹ | V ² | m.p. °C |
|---------|---|-----------------|---|----------------|----------------|---------|
| I-6-1 | H | CH ₃ | H | 4-F | H | 141-143 |
| I-6-2 | H | CH ₃ | H | 4-Cl | H | 164-165 |
| I-6-3 | H | Cl | H | 4-F | H | 186-188 |
| I-6-4 | H | Cl | H | 4-Cl | H | oil |



| Ex. No. | W | X | Z | V ¹ | V ² | m.p. °C |
|---------|---|-----------------|---|----------------|----------------|---------|
| I-7-1 | H | CH ₃ | H | 4-F | H | oil |
| I-7-2 | H | Cl | H | 4-Cl | H | oil |



| Ex. No. | W | X | Z | V ¹ | V ² | m.p. °C |
|---------|---|-----------------|---|----------------|----------------|---------|
| I-8-1 | H | CH ₃ | H | 4-Cl | H | 193 |
| I-8-2 | H | Cl | H | 4-Cl | H | oil |

Use Examples

Example A

Meloidogyne test

Solvent: 7 parts by weight of dimethylformamide

5 Emulsifier: 2 parts by weight of alkylaryl polyglycol ether

To produce a suitable preparation of active compound, 1 part by weight of active compound is mixed with the stated amounts of solvent and emulsifier, and the concentrate is diluted with water to the desired concentration.

10 Containers are filled with sand, solution of active compound, Meloidogyne incognita egg/larvae suspension and lettuce seeds. The lettuce seeds germinate and the plants develop. On the roots, galls are formed.

After the desired period of time, the nematicidal action is determined in % by the formation of galls. 100% means that no galls were found; 0% means that the number of galls on the treated plants corresponds to that of the untreated control.

15 In this test, for example, the following compound of the Preparation Examples is effective:

Table A

Plant-damaging nematodes
Meloidogyne test

| 5 | Active compounds | Concentration of active compound in ppm | Effect in % after 14d |
|----|------------------|---|-----------------------|
| | Ex. I-3-1 | 20 | 100 |
| 10 | | | |

Example B

Myzus test (spray treatment)

Solvents: 78 parts by weight of acetone

1.5 parts by weight of dimethylformamide

5 Emulsifier: 0.5 part by weight of alkylaryl polyglycol ether

To produce a suitable preparation of active compound, 1 part by weight of active compound is mixed with the stated amounts of solvent and emulsifier, and the concentrate is diluted with emulsifier-containing water to the desired concentration.

10 Discs of Chinese cabbage (*Brassica pekinensis*) which are infested by all stages of the green peach aphid (*Myzus persicae*) are sprayed with a preparation of active compound of the desired concentration.

After the desired period of time, the activity in % is determined. 100% means that all aphids have been killed; 0% means that none of the aphids have been killed.

15 In this test, for example, the following compounds of the Preparation Examples are highly effective:

Table B

Plant-damaging insects
Myzus test

| | Active compounds | Concentration of active compound in g/ha | Kill rate in % after 5 ^d |
|----|------------------|--|-------------------------------------|
| 5 | Ex. I-1-1 | 100 | 100 |
| 10 | Ex. I-1-7 | 500 | 90 |
| | Ex. I-1-13 | 500 | 90 |
| | Ex. I-1-17 | 500 | 90 |
| 15 | Ex. I-2-29 | 500 | 100 |
| | Ex. I-2-6 | 500 | 90 |
| 20 | Ex. I-2-23 | 500 | 100 |
| | Ex. I-1-34 | 500 | 100 |
| | Ex. I-2-16 | 500 | 100 |
| 25 | Ex. I-2-18 | 500 | 90 |
| | Ex. I-2-35 | 500 | 100 |

Example C

Phaedon test (spray treatment)

Solvents: 78 parts by weight of acetone
 1.5 parts by weight of dimethylformamide

5 Emulsifier: 0.5 part by weight of alkylaryl polyglycol ether

To produce a suitable preparation of active compound, 1 part by weight of active compound is mixed with the stated amounts of solvents and emulsifier, and the concentrate is diluted with emulsifier-containing water to the desired concentration.

Discs of Chinese cabbage (*Brassica pekinensis*) are sprayed with a preparation of active compound

10 of the desired concentration and, after they have dried, populated with larvae of the mustard beetle (*Phaedon cochleariae*).

After the desired period of time, the activity in % is determined. 100% means that all beetle larvae have been killed; 0% means that none of the beetle larvae have been killed.

In this test, for example, the following compounds of the Preparation Examples are highly effective:

Table C

Plant-damaging insects

Phaedon test

| | Active compounds | Concentration of active compound in g/ha | Kill rate in % after 7d |
|----|------------------|---|----------------------------|
| 5 | | | |
| | Ex. I-1-1 | 100 | 100 |
| | Ex. I-1-6 | 500 | 100 |
| 10 | Ex. I-1-7 | 500 | 100 |
| | Ex. I-1-14 | 500 | 100 |
| 15 | Ex. I-1-17 | 500 | 100 |
| | Ex. I-2-1 | 500 | 100 |
| | Ex. I-2-6 | 500 | 100 |
| 20 | Ex. I-1-10 | 500 | 100 |
| | Ex. I-1-11 | 500 | 100 |
| 25 | Ex. I-1-18 | 500 | 100 |
| | Ex. I-2-10 | 500 | 100 |

Table C

Plant-damaging insects

Phaedon test

| Active compounds | Concentration of active compound in g/ha | Kill rate in % after 7d |
|------------------|---|----------------------------|
| Ex. I-2-12 | 500 | 100 |
| Ex. I-1-29 | 500 | 100 |
| 10 / | | |
| Ex. I-2-15 | 500 | 100 |
| Ex. I-2-17 | 500 | 100 |
| 15 Ex. I-2-20 | 500 | 100 |
| Ex. I-2-27 | 500 | 100 |
| Ex. I-2-14 | 500 | 100 |
| 20 Ex. I-2-34 | 500 | 100 |

Example D

Spodoptera frugiperda test (spray treatment)

Solvents: 78 parts by weight of acetone

 1.5 parts by weight of dimethylformamide

5 Emulsifier: 0.5 part by weight of alkylaryl polyglycol ether

To produce a suitable preparation of active compound, 1 part by weight of active compound is mixed with the stated amounts of solvents and emulsifier, and the concentrate is diluted with emulsifier-containing water to the desired concentration.

Discs of maize leaves (*Zea mays*) are sprayed with a preparation of active compound of the desired 10 concentration and, after they have dried, populated with caterpillars of the army worm (*Spodoptera frugiperda*).

After the desired period of time, the activity in % is determined. 100% means that all caterpillars have been killed; 0% means that none of the caterpillars have been killed.

In this test, for example, the following compounds of the Preparation Examples are highly 15 effective:

Table D

Plant-damaging insects
Spodoptera frugiperda test

| Active compounds | Concentration of active compound in g/ha | Kill rate in % after 7 ^d |
|------------------|--|-------------------------------------|
| 5 Ex. I-1-22 | 100 | 100 |
| 10 Ex. I-2-7 | 100 | 100 |
| 15 Ex. I-1-6 | 500 | 100 |
| 20 Ex. I-1-8 | 500 | 100 |
| 25 Ex. I-1-15 | 500 | 100 |
| 30 Ex. I-2-4 | 500 | 100 |
| Ex. I-2-13 | 500 | 100 |
| Ex. I-2-16 | 500 | 100 |
| Ex. I-2-18 | 500 | 100 |
| Ex. I-1-19 | 500 | 100 |
| Ex. I-2-21 | 500 | 100 |
| Ex. I-2-2 | 500 | 100 |
| Ex. I-2-3 | 500 | 100 |

Example E

Tetranychus test (OP-resistance/spray treatment)

Solvents: 78 parts by weight of acetone
 1.5 parts by weight of dimethylformamide

5 Emulsifier: 0.5 part by weight of alkylaryl polyglycol ether

To prepare a suitable preparation of active compound, 1 part by weight of active compound is mixed with the stated amounts of solvents and emulsifier, and the concentrate is diluted with emulsifier-containing water to the desired concentration.

Discs of bean leaves (*Phaseolus vulgaris*) which are infested by all stages of the greenhouse red

10 spider mite (*Tetranychus urticae*) are sprayed with a preparation of active compound of the desired concentration.

After the desired period of time, the activity in % is determined. 100% means that all spider mites have been killed; 0% means that none of the spider mites have been killed.

In this test, for example, the following compounds of the Preparation Examples are highly effective:

15

Table E

Plant-damaging mites
Tetranychus test (OP-resistance/spray treatment)

| | Active compounds | Concentration of active compound in g/ha | Kill rate in % after 5 ^d |
|----|------------------|---|--|
| 5 | Ex. I-2-7 | 100 | 90 |
| 10 | Ex. I-4-1 | 100 | 90 |
| 15 | Ex. I-1-3 | 500 | 100 |
| 20 | Ex. I-1-8 | 500 | 100 |
| 25 | Ex. I-1-13 | 500 | 100 |
| 30 | Ex. I-1-14 | 500 | 100 |
| 35 | Ex. I-2-28 | 500 | 90 |
| | Ex. I-2-5 | 500 | 90 |
| | Ex. I-1-10 | 500 | 100 |
| | Ex. I-2-9 | 500 | 90 |
| | Ex. I-1-29 | 500 | 100 |
| | Ex. I-2-22 | 100 | 90 |
| | Ex. I-2-19 | 500 | 90 |
| | Ex. I-1-12 | 500 | 90 |
| | Ex. I-2-27 | 100 | 100 |

Example F

In vitro test for the ED₅₀ determination in microorganisms

A methanolic solution of the active compound to be tested, admixed with emulsifier PS16, is pipetted into the wells of microtitre plates. After the solvent has evaporated, 200 µl of potato/dextrose medium are added to each well.

Beforehand, a suitable concentration of spores or mycelium of the fungus to be tested was added to the medium.

The resulting concentrations of the active compound are 0.1, 1, 10 and 1000 ppm. The resulting concentration of the emulsifier is 300 ppm.

- 10 The plates are then incubated on a shaker at a temperature of 22°C for 3-5 days, until sufficient growth can be observed in the untreated control.

Evaluation is carried out photometrically at a wavelength of 620 nm. The dose of active compound which causes 50% inhibition of fungal growth compared to the untreated control (ED₅₀) is calculated from data measured at different concentrations.

Table F

In vitro test for the ED₅₀ determination in microorganisms

| Active compounds | Microorganisms | ED ₅₀ value |
|------------------|------------------|------------------------|
| 5 Ex. I-1-1 | Botrytis cinerea | 0.45 |
| Ex. I-1-22 | Botrytis cinerea | 0.75 |
| 10 Ex. I-1-5 | Botrytis cinerea | 0.33 |

Example G

Herbicidal pre-emergence action

Seeds of monocotyledonous and dicotyledonous weed and crop plants are placed into sandy loam in wood fibre pots and covered with soil. The test compounds, formulated in the form of wettable powders (WP), are then, in various dosages as aqueous suspension with a water application rate of 5 600 l/ha (converted), with 0.2% of wetting agent added, applied to the surface of the covering soil.

After the treatment, the pots are placed in a greenhouse and kept under good growth conditions for the test plants. The visual assessment of the emergence damage on the test plants is carried out after a trial period of 3 weeks by comparison with untreated controls (herbicidal effect in per cent 10 (%): 100% effect = the plants have died, 0% effect = like control plants).

Example H

Herbicidal post-emergence action

Seeds of monocotyledonous and dicotyledonous weed and crop plants are placed into sandy loam in wood fibre pots, covered with soil and cultivated in a greenhouse under good growth conditions.

15 2-3 weeks after sowing, the test plants are treated at the one-leaf stage. The test compounds, formulated as wettable powders (WP), are, in various dosages with a water application rate of 600 l/ha (converted), with 0.2% of wetting agent added, sprayed onto the green parts of the plants. After the test plants were kept in a greenhouse under optimum growth conditions for about 3 weeks, the effect of the preparations is rated visually in comparison to untreated controls 20 (herbicidal effect in per cent (%): 100% effect = the plants have died, 0% effect = like control plants).

| Greenhouse | | g of a.i./ha | Echinochloea | Setaria | Sorghum | Wheat | Soybeans |
|------------|----------------|------------------------|--------------|-----------|---------|---------|------------|
| | pre-emergence | 320 | 70 | 80 | 70 | 0 | 0 |
| Ex. I-4-1 | post-emergence | g of a.i./ha 320 | Alopecurus | Digitaria | Lolium | Setaria | Sugarbeets |

Example I

Herbicidal post-emergence action

Seeds of monocotyledonous and dicotyledonous weed and crop plants are placed into sandy loam in wood fibre pots or in plastic pots, covered with soil and cultivated in a greenhouse, during the vegetation period also outdoors outside of the greenhouse, under good growth conditions. 5 2-3 weeks after sowing, the test plants are treated at the one- to three-leaf stage. The test compounds, formulated as wettable powders (WP), or emulsifiable concentrates (EC), are, in various dosages with a water application rate of 300 l/ha (converted), with wetting agent (0.2 to 0.3%) added, sprayed onto the plants and the surface of the soil. 10 3-4 weeks after the treatment of the test plants, the effect of the preparations is rated visually in comparison to untreated controls (herbicidal effect in per cent (%)): 100% effect = the plants have died, 0% effect = like control plants).

Use of safeners

If it is additionally to be tested whether safeners can improve the plant compatibility of test substances in the case of the crop plants, the following option is used for applying the safener:

- 15 - seeds of the crop plants are, before sowing, dressed with the safener substance (the amount of safener is stated in per cent, based on the weight of seed)
- before the application of the test substances, the crop plants are sprayed with the safener at a certain application rate per hectare (usually 1 day before the application of the test substances)
- 20 - the safener is applied together with the test substance as a tank mix (the amount of safener is stated in g/ha or as a ratio, based on the herbicide).

By comparing the effect of test substances on crop plants without or with safener treatment, it is possible to assess the effect of the safener substance.

Container trials with cereals in the greenhouse

| | Application rate g of a.i./ha | Summer barley observed (%) | Summer wheat observed (%) |
|-----------------------------|----------------------------------|-------------------------------|------------------------------|
| Example I-3-1 | 100 | 80 | 60 |
| | 50 | 80 | 60 |
| Example I-3-1 + mefenpyr | 100 + 100 | 20 | 15 |
| | 50 + 100 | 0 | 5 |

| | Application rate g of a.i./ha | Summer barley observed (%) | Summer wheat observed (%) |
|-----------------------------|----------------------------------|-------------------------------|------------------------------|
| Example I-4-1 | 100 | 97 | 97 |
| | 50 | 95 | 97 |
| | 25 | 40 | 60 |
| Example I-4-1 + mefenpyr | 100 + 100 | 20 | 80 |
| | 50 + 100 | 10 | 40 |
| | 25 + 100 | 0 | 20 |

Post-emergence application

Mefenpyr 1 day before the herbicide application

Example J

5 Critical concentration test/soil insects – treatment of transgenic plants

Test insect: Diabrotica balteata – larvae in soil

Solvent: 7 parts by weight of acetone

Emulsifier: 1 part by weight of alkylaryl polyglycol ether

10 To produce a suitable preparation of active compound, 1 part by weight of active compound is mixed with the stated amount of solvent, the stated amount of emulsifier is added and the concentrate is diluted with water to the desired concentration.

15 The preparation of active compound is poured onto the soil. Here, the concentration of active compound in the preparation is virtually immaterial, only the amount by weight of active compound per volume unit of soil, which is stated in ppm (mg/l), matters. The soil is filled into 0.25 l pots, and these are allowed to stand at 20°C.

Immediately after the preparation, 5 pregerminated maize corns of the cultivar YIELD GUARD (trade mark of Monsanto Comp., USA) are placed into each pot. After 2 days, the appropriate test insects are placed into the treated soil. After a further 7 days, the efficacy of the active compound is determined by counting the maize plants that have emerged (1 plant = 20% activity).

Example K

Heliothis virescens test – treatment of transgenic plants

Solvent: 7 parts by weight of acetone

Emulsifier: 1 part by weight of alkylaryl polyglycol ether

- 5 To produce a suitable preparation of active compound, 1 part by weight of active compound is mixed with the stated amount of solvent and the stated amount of emulsifier, and the concentrate is diluted with water to the desired concentration.

Soyabean shoots (*Glycine max*) of the cultivar Roundup Ready (trade mark of Monsanto Comp.

USA) are treated by being dipped into the preparation of active compound of the desired

- 10 concentration and are populated with the tobacco budworm *Heliothis virescens* while the leaves are still moist.

After the desired period of time, the kill of the insects is determined.